SEAMAP-SA

RESULTS OF TRAWLING EFFORTS IN THE COASTAL HABITAT OF THE SOUTH ATLANTIC BIGHT, 2004

Prepared By

SEAMAP - SA Shallow Water Trawl Survey

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INTRODUCTION

The Southeast Area Monitoring and Assessment Program - South Atlantic (SEAMAP-SA) Shallow Water Trawl Survey, funded by the National Marine Fisheries Service (NMFS) and conducted by the South Carolina Department of Natural Resources - Marine Resources Division (SCDNR-MRD), began in 1986. This survey provides long-term, fishery-independent data on seasonal abundance and biomass of all finfish, elasmobranchs, decapod and stomatopod crustaceans, sea turtles, horseshoe crabs, and cephalopods that are accessible by high-rise trawls. Additional data recorded for priority species include measurements of length or width for all priority species, sex and individual weights for sharks, sea turtles, and horseshoe crabs, and reproductive information on commercially important penaeid shrimp and blue crabs. Otolith and gonad samples were taken from three species of priority finfish.

Field data collected by the SEAMAP-SA Shallow Water Trawl Survey are available to users within a few weeks of collection. SEAMAP-SA trawl data collected from 1986 to the present are now available through the SEAMAP-SA Data Management Office at NMFS[1]. Management agencies and scientists currently have access to fifteen years (1990-2004) of comparable trawl data from near-shore coastal areas of the South Atlantic Bight.

This report summarizes information on species composition, abundance, and biomass from SEAMAP-SA trawls. Length-frequency distributions of commercially and ecologically important priority species, along with reproductive attributes of the commercially important penaeid species and ageing and maturity of selected sciaenids, are presented.

[1]Data are available through the SEAMAP Data Manager (NMFS Mississippi Laboratory, P.O. Box 1207, Pascagoula, MS 39568-1207).

METHODS AND MATERIALS

Data Collection

Samples were taken by trawl from the coastal zone of the South Atlantic Bight (SAB) between Cape Hatteras, North Carolina, and Cape Canaveral, Florida (Figure 1). Multi-legged cruises were conducted in spring (early April - mid-May), summer (mid-July - early August), and fall (October - mid-November).

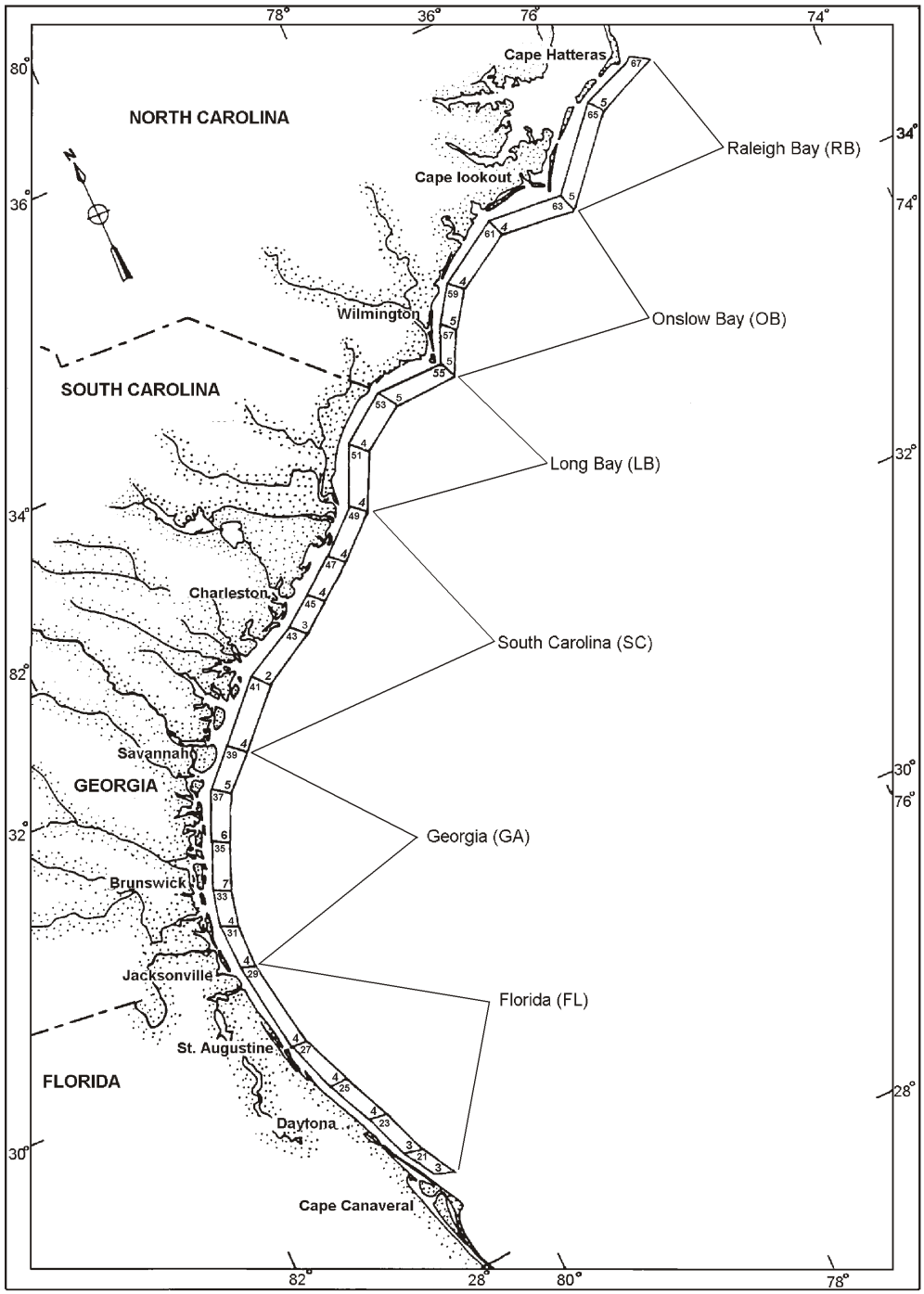

Figure 1. Strata sampled by the SEAMAP-SA Shallow Water Trawl Survey in 2004. Stratum number is indicated at the top of each rectangle and number of trawls towed is located in the lower portion of each stratum. (Strata are not drawn to scale.)

Stations were randomly selected from a pool of stations within each stratum. The number of stations sampled in each stratum was determined by optimal allocation. A total of 102 stations were sampled each season within twenty-four shallow water strata, representing an increase from 78 stations previously sampled in those strata by the trawl survey (1990-2000). Strata were delineated by the 4 m depth contour inshore and the 10 m depth contour offshore. In previous years (1989-2000), stations were also sampled in deeper strata with station depths ranging from 10 to 19 m in order to gather data on the reproductive condition of commercial penaeid shrimp. Those strata were abandoned in 2001 in order to intensify sampling in the more shallow depth-zone.

The R/V *Lady Lisa*, a 75-ft (23-m) wooden-hulled, double-rigged, St. Augustine shrimp trawler owned and operated by the South Carolina Department of Natural Resources (SCDNR), was used to tow paired 75-ft (22.9-m) mongoose-type Falcon trawl nets (manufactured by Beaufort Marine Supply; Beaufort, S.C.) without TED's. The body of the trawl was constructed of #15 twine with 1.875-in (47.6-mm) stretch mesh. The cod end of the net was constructed of #30 twine with 1.625-in (41.3-mm) stretch mesh and was protected by chafing gear of #84 twine with 4-in (10-cm) stretch "scallop" mesh. A 300 ft (91.4-m) three-lead bridle was attached to each of a pair of wooden chain doors which measured 10 ft x 40 in (3.0-m x 1.0-m), and to a tongue centered on the head-rope. The 86-ft (26.3-m) head-rope, excluding the tongue, had one large (60-cm) Norwegian "polyball" float attached top center of the net between the end of the tongue and the tongue bridle cable and two 9-in (22.3-cm) PVC foam floats located one-quarter of the distance from each end of the net webbing. A 1-ft chain drop-back was used to attach the 89-ft foot-rope to the trawl door. A 0.25-in (0.6-cm) tickler chain, which was 3.0-ft (0.9-m) shorter than the combined length of the foot-rope and drop-back, was connected to the door alongside the foot-rope.

Trawls were towed for twenty minutes, excluding wire-out and haul-back time, exclusively during daylight hours (1 hour after sunrise to 1 hour before sunset). Each net was processed separately and assigned a unique collection number. Contents of each net were sorted to species (or genus in a few cases), and total biomass and number of individuals were recorded for all species of finfish, elasmobranchs, decapod and stomatopod crustaceans, cephalopods, sea turtles, xiphosurans, and cannonball jellies. Only total biomass was recorded for all other miscellaneous invertebrates and algae, which were treated as two separate taxonomic groups.

Where large numbers of individuals of a species occurred in a collection, the entire catch was sorted and all individuals of that species were weighed, but only a randomly selected subsample was processed and total number was calculated. For large trawl catches, the contents of each net were weighed prior to sorting and a randomly chosen subsample of the total catch was then sorted and processed.

In every collection, each of the priority species was weighed collectively and individuals were measured to the nearest centimeter (Appendix 1). For large collections of any of the priority species, a random subsample consisting of thirty to fifty individuals was weighed and measured. Depending on the species, measurements were recorded as total length, fork length, or carapace width.

Additional data were collected on individual specimens of penaeid shrimp (total length in mm, sex, female ovarian development, male spermatophore development, occurrence of mated females), blue crabs (carapace width in mm, individual weight, sex, presence and developmental stage of eggs), sharks (total and fork lengths in cm, individual weight, sex), horseshoe crabs (prosoma width and length in mm, individual weight, sex), and sea turtles (curved and straight lengths and widths in cm, individual weight, PIT and flipper tag numbers). Marine turtles were released in good condition according to NMFS permitting guidelines.

Gonad and otolith specimens from three sciaenid species were also collected during seasonal cruises. A representative sample of specimens from each centimeter size range within each stratum were measured to the nearest mm (TL and SL), weighed to the nearest gram, and assigned a sex and maturity code (Wenner et al., 1986). Sagittal otoliths and a representative series of gonadal tissue were removed, preserved, and transported to the laboratory at MRRI, where samples were processed (Walton, 1996). Results of data collected from specimens of *Cynoscion regalis, Menticirrhus americanus,* and *Micropogonias undulatus* are presented in this report.

Hydrographic data collected at each station included surface to bottom temperature and salinity measurements taken with a Seabird SBE-19 CTD profiler, sampling depth, and an estimate of wave height. Additionally, atmospheric data on air temperature, barometric pressure, precipitation, and wind speed and direction were also noted at each station.

Data Analysis

The SAB was separated into six regions for data analysis (Figure 1). Raleigh Bay (RB), Onslow Bay (OB) and Long Bay (LB) were each considered to be regions. South Carolina, excluding Long Bay (SC); Georgia, including northern Florida south to the St. Johns River (GA), and Florida from the St. Johns River to Cape Canaveral (FL) were also treated as separate regions.

Data from the paired trawls were pooled for analysis to form a standard unit of effort (tow). In an effort to reduce the variability of the data, in 2001 the method of allocating the number of stations within each stratum was changed from proportional allocation to optimal allocation (Thompson, 1992). The coefficient of variation (CV), expressed as a proportion, was used to compare relative amounts of variation in abundance among years and among species (Sokal and Rohlf, 1981). Density estimates, expressed as number of individuals or kilograms per hectare (ha), were standardized by dividing the mean catch per tow by the mean area (ha) swept by the combined trawls. Mean area swept by a net was calculated by multiplying the width of the net opening (13.5 m), as determined by Stender and Barans (1994), by the distance (m) trawled and dividing the product by 10,000 m^2/ha.

Results for priority species are presented and discussed individually in this report. Statistically significant differences in lengths of individuals among seasons and regions were determined using the non-parametric Kruskal-Wallis test (Sokal and Rohlf, 1981). Size differences among shark genders were tested for statistical differences with the non-parametric Wilcoxon test. Contingency tables using the G-statistic were used to determine if occurrence of ripe penaeid shrimp were independent of season and region.

Seasonal age-length keys for *Cynoscion regalis, Menticirrhus americanus,* and *Micropogonias undulatus* (Appendix 2) were generated and applied to expanded seasonal length-frequencies to determine the age composition of those species in SEAMAP-SA trawl samples.

RESULTS AND DISCUSSION

Hydrographic Measurements

Hydrographic patterns of temperature and salinity in the SAB are driven by four major influences which fluctuate seasonally: river run-off, the Gulf Stream, a southerly flowing coastal current, and atmospheric conditions. The warm, highly saline waters of the Gulf Stream, in close proximity to coastal waters off Florida and in Raleigh Bay, elevate temperatures and salinities in those areas (Pietrafesa et al., 1985). Most of the river run-off in the SAB occurs south of Cape Fear (Blanton and Atkinson, 1983; McClain et al., 1988). Water of lower salinity created by freshwater influx is pushed southward by the southerly flowing coastal current; however, this movement is impeded by the northerly flowing Gulf Stream off northern Florida (Blanton, 1981; Blanton and Atkinson, 1983). The result of this process is a concentration of lower salinity water off southern South Carolina and Georgia. Seasonal fluctuations in river run-off, atmospheric conditions, and migrations of the Gulf Stream dictate the magnitudes of these hydrographic patterns.

Typical seasonal and regional patterns of temperature and salinity were observed during the 2004 survey (Table 1). Both annual and seasonal mean temperatures and mean salinities were slightly higher than the estimates calculated for 1989-2004 ($\bar{x}$ = 22.8 °C, 34.4 ‰).

Table 1. Seasonal mean bottom temperatures (°C) and salinities (‰) from each region for 2004. Regions are abbreviated as follows: Raleigh Bay (RB), Onslow Bay (OB), Long Bay (LB), South Carolina (SC), Georgia (GA), and Florida (FL).

	RB	OB	LB	SC	GA	FL	ALL REGIONS
SPRING							
$\bar{x}$ Temperature	16.1	15.9	17.3	19.5	21.4	21.3	19.0
$\bar{x}$ Salinity	33.6	34.8	34.8	34.2	34.1	36.3	34.7
SUMMER							
$\bar{x}$ Temperature	25.9	26.3	25.0	26.7	27.5	23.4	26.0
$\bar{x}$ Salinity	36.3	36.2	36.0	36.0	35.7	36.2	36.0
FALL							
$\bar{x}$ Temperature	22.0	22.7	25.2	22.7	24.1	24.6	23.6
$\bar{x}$ Salinity	29.7	33.4	33.6	32.9	32.2	33.7	32.7
ALL SEASONS							
$\bar{x}$ Temperature	21.3	21.7	22.4	23.0	24.3	23.1	22.9
$\bar{x}$ Salinity	33.3	34.8	34.8	34.4	34.0	35.4	34.5

Species Composition

The 2004 sampling effort resulted in the collection of 185 species (Appendix 3). Trawls produced 112 species of finfish, 26 species of elasmobranchs, 37 species of decapod crustaceans, 3 species of stomatopod crustaceans, 3 genera of cephalopods, 3 species of marine turtles, and one species of xiphosuran.

The number of species collected varied seasonally (Table 2), with greatest diversity from trawls towed in spring. Summer, the season of peak abundance, produced the lowest number of species. Regionally, the greatest diversity was found in waters off Georgia, whereas the lowest number of species was taken in Raleigh Bay.

Table 2. Summary of effort (number of trawl tows), diversity (number of species), abundance (number of individuals), biomass (kg), density of individuals (number/ha), and density of biomass (kg/ha), excluding miscellaneous invertebrates, cannonball jellies, and algae, by region and season.

	Effort	Diversity	Abundance		Density	
	(Tows)	(Species)	Individuals	Biomass	Individuals	Biomass
Region						
RALEIGH BAY	30	93	138,546	10297	1235.4	91.8
ONSLOW BAY	54	123	200,654	11039	1013.2	55.7
LONG BAY	39	122	79,274	4841	566.6	34.6
S. CAROLINA	54	123	42,366	3384	217.2	17.4
GEORGIA	78	131	86,094	3026	297.3	10.4
FLORIDA	54	120	87,264	6915	446.4	35.4
Season						
SPRING	102	142	263,401	17074	690.8	44.8
SUMMER	102	136	199,558	12492	543.1	34.0
FALL	102	131	171,239	9937	461.6	26.8

Abundance, Biomass, and Density Estimates

The 2004 SEAMAP-South Atlantic Shallow Water Trawl Survey caught 634,198 individuals (CV=5.5; 2073 individuals/tow), with a biomass of 43,012 kg (140.6 kg/tow). Miscellaneous invertebrates, cannonball jellies, and algae contributed an additional 3691 kg of biomass. The overall density of individuals (566 individuals/ha) in 2004 (excluding cannonball jellies) represents the highest abundance observed in the history of the survey (Figure 2). This increase was accompanied by a decrease in variability.

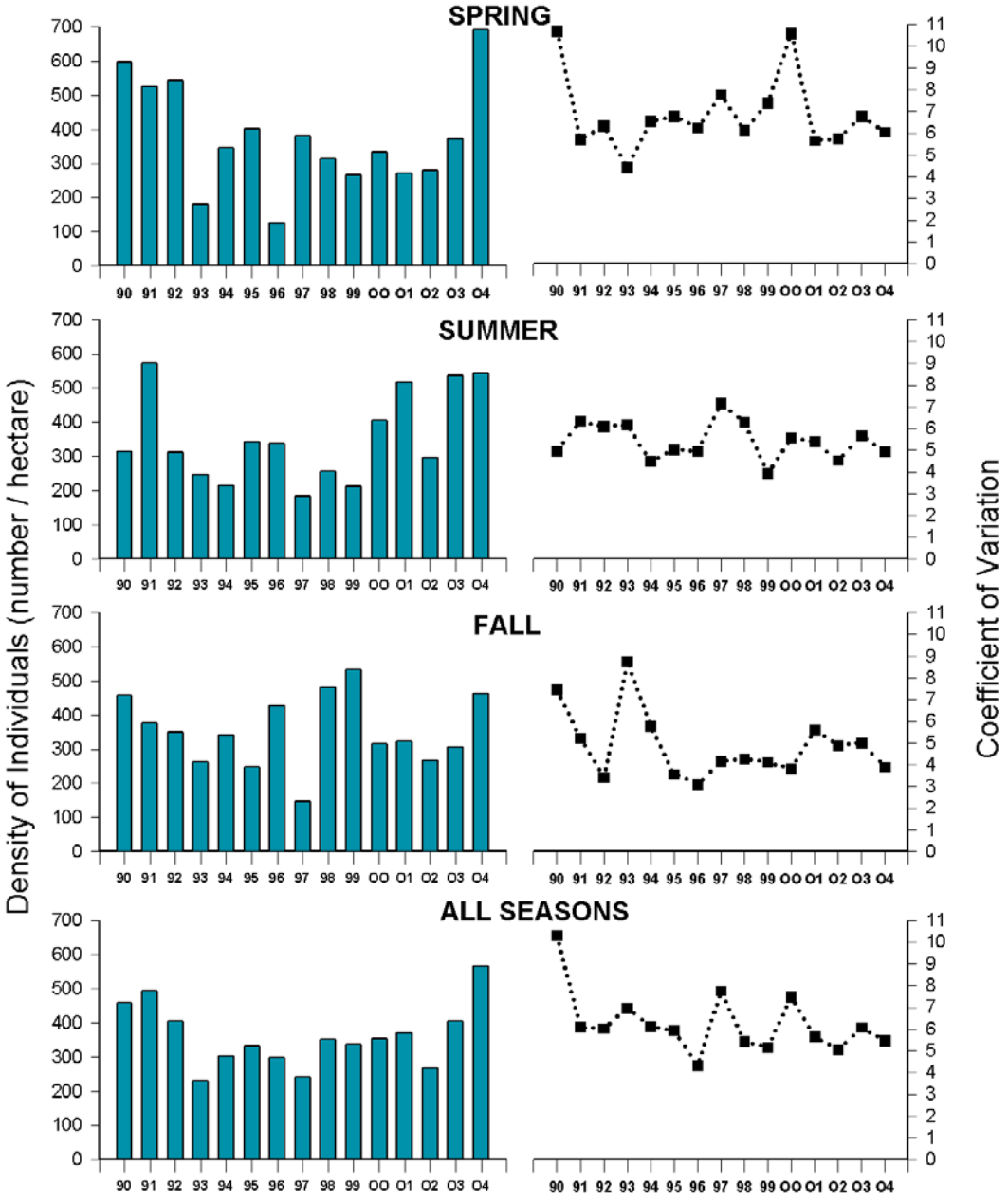

Figure 2. Annual and seasonal densities of abundance from inner strata.

In 2004, both densities of individuals and densities of biomass peaked in spring collections (Table 2). The highest regional densities of individuals and biomass occurred in Raleigh Bay, reflecting relatively large catches of sciaenids. South Carolina had the lowest density of individuals and Georgia the lowest density of biomass.

Historically, patterns of abundance in the SAB generally reflect the abundance of two members of the sciaenid family, the spot, *Leiostomus xanthurus*, and the Atlantic croaker, *Micropogonias undulatus,* which have been consistent in their numerical dominance among years. These two species constituted approximately 30% of the total catch during the 2004 survey. *Micropogonias undulatus* ranked first in both abundance and biomass, followed by A*nchoa hepsetus* and *Leiostomus xanthurus* (Table 3). Other species of numerical importance included the butterfish, *Peprilus triacanthus*; the scup, *Stenotomus sp.*; the white shrimp, *Litopenaeus setiferus*; the pinfish, *Lagodon rhomboides*; and the banded drum, *Larimus fasciatus*;

Table 3. Regional and seasonal estimates of density of abundance (individuals/ha) and biomass (kg/ha), excluding miscellaneous invertebrates, cannonball jellies, and algae, for dominant species in 2004.

	All	Region						Season		
	Strata	**RB**	**OB**	**LB**	**SC**	**GA**	**FL**	**SPR**	**SUM**	**FAL**
Abundance										
Micropogonias undulatus	96.6	326.0	166.1	145.6	7.1	7.3	76.1	22.4	201.1	69.5
Anchoa hepsetus	72.9	52.0	239.0	48.2	31.6	41.6	18.2	173.3	5.2	36.8
Leiostomus xanthurus	61.8	143.7	165.6	48.6	15.2	4.3	47.5	107.0	56.6	20.6
Peprilus triacanthus	34.7	129.0	84.0	12.2	3.4	4.9	20.6	97.1	3.0	2.1
Stenotomus sp.	26.4	67.9	80.4	15.7	1.9	12.0	0.02	28.5	30.3	20.4
Litopenaeus setiferus	25.8	3.9	18.8	42.0	14.7	24.0	46.3	8.6	4.4	64.6
Biomass										
Micropogonias undulatus	6.7	17.2	12.5	7.9	4.1	0.3	5.4	1.6	14.4	4.2
Leiostomus xanthurus	3.3	7.2	8.0	2.2	0.7	0.2	4.0	5.1	2.9	1.8
Menticirrhus americanus	1.6	4.1	1.8	1.0	1.1	0.7	2.2	2.3	1.2	1.3
Mustelus canis	1.5	9.7	2.2	0.8	0.03	0.009	0.003	4.3	0.01	0.003
Peprilus triacanthus	1.5	6.0	4.1	0.3	0.1	0.07	0.4	4.2	0.1	0.07

Distribution and Abundance of Priority Finfish Species

Archosargus probatocephalus

The sheepshead, *Archosargus probatocephalus*, exhibited an increase in abundance in 2004. Catches of sheepshead peaked in 1992 and dropped to the lowest level in 2003 (Figure 4). Only 16 sheepshead (CV=8.4; 0.01 individuals/ha), weighing a total of 45 kg, were taken in 2004. Sheepshead were taken only in spring and fall in 2004 and were most abundant in Onslow Bay in fall (Table 4). Fork lengths ranged from 42 to 54cm ($\bar{x}$ = 48.1).

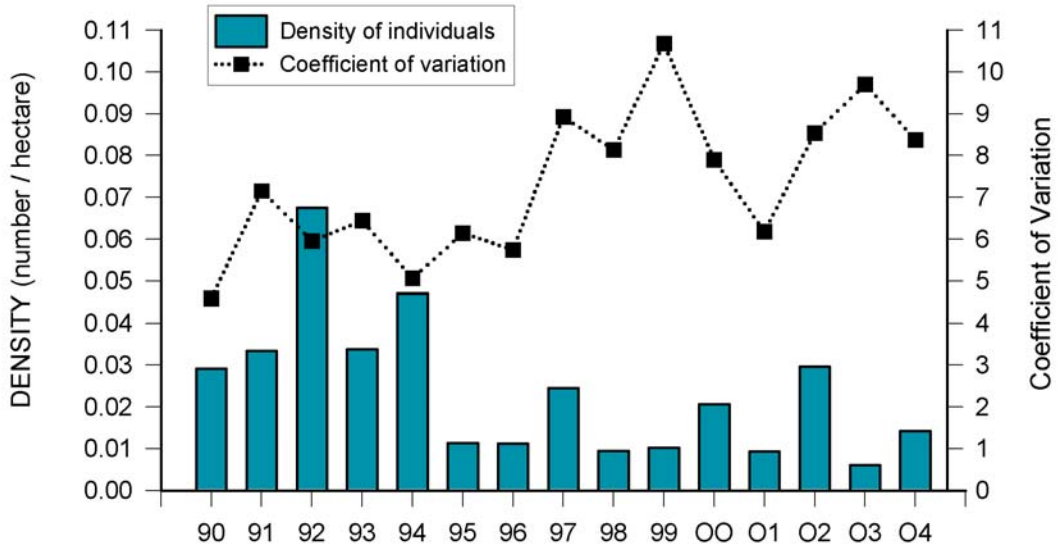

Figure 3. Annual densities of *Archosargus probatocephalus*

Table 4 . Estimates of density (number of individuals/hectare) in 2004.

Archosargus probatocephalus

	Spring	Summer	Fall	
Raleigh Bay	0.03	0	0	0.009
Onslow Bay	0	0	0.2	0.06
Long Bay	0	0	0	0
South Carolina	0	0	0	0
Georgia	0.03	0	0	0.01
Florida	0	0	0	0
Season	0.01	0	0.03	0.01

Brevoortia smithi

A total of only 3 yellowfin menhaden (CV=10.1; 0.002 individuals/ha), weighing 1 kg, were collected by the SEAMAP-SA Shallow Water Trawl Survey in 2004. Although density of individuals for this species peaked in 1991 (Figure 4), abundance of *Brevoortia smithi* is generally low in SEAMAP-SA trawl samples. In 2004, all yellowfin menhaden were caught in waters off Florida in fall (Table 5). Fork lengths of *B. smithi* ranged from 24 to 29 cm ($\bar{x}$ = 27.0).

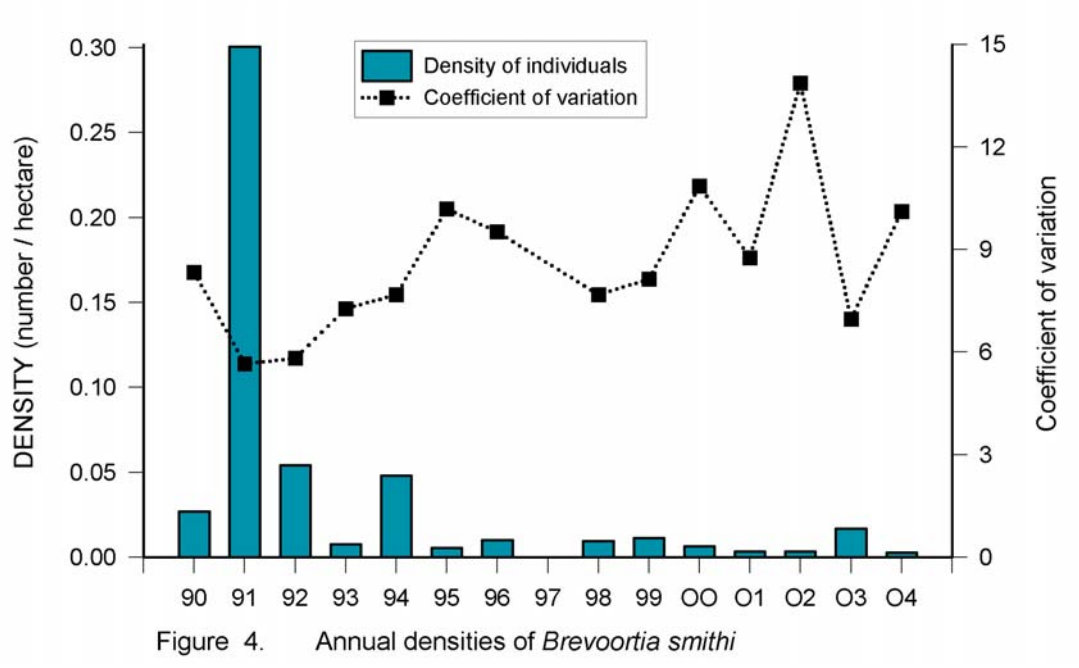

Figure 4. Annual densities of *Brevoortia smithi*

Table 5 . Estimates of density (number of individuals/hectare) in 2004.

Brevoortia smithi

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0	0	0	0
Long Bay	0	0	0	0
South Carolina	0	0	0	0
Georgia	0	0	0	0
Florida	0	0	0.05	0.02
Season	0	0	0.008	0.003

Brevoortia tyrannus

A total of 945 Atlantic menhaden (CV=7.7; 0.8 individuals/ha), weighing 44 kg (0.04 kg/ha), were taken in SEAMAP-SA trawls. Density of individuals was at the highest level in the history of the survey in 1990 (Figure 5), with much lower abundance observed during the subsequent fourteen years. In 2004, density was greatest in spring and in Raleigh Bay (Table 6).

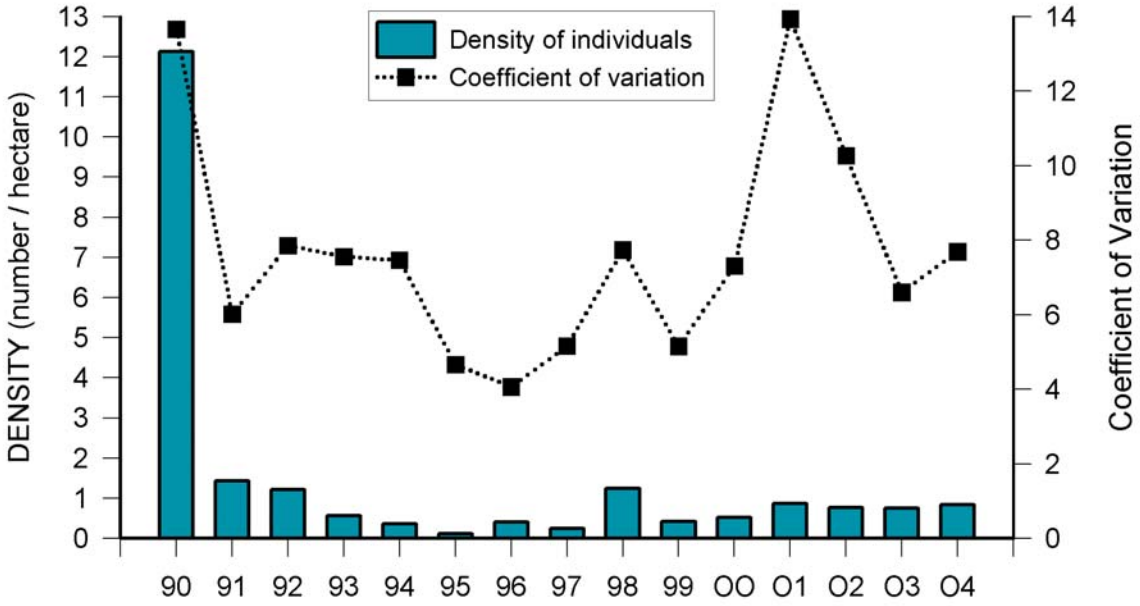

Figure 5. Annual densities of *Brevoortia tyrannus*

Table 6 . Estimates of density (number of individuals/hectare) in 2004.

Brevoortia tyrannus

	Spring	Summer	Fall	Region
Raleigh Bay	14.4	0.1	0.1	4.6
Onslow Bay	0.2	0	0	0.06
Long Bay	0.3	0	0.1	0.1
South Carolina	0	0	0.08	0.03
Georgia	0.2	0.01	0.3	0.2
Florida	0.6	0.2	4.9	1.8
Season	1.6	0.05	0.9	0.8

Fork lengths of *Brevoortia tyrannus* ranged from 8 to 22 cm ($\bar{x}$ = 13.4). Length was found to be significantly different among seasons ($X^2 = 381$, $p < 0.0001$) and regions ($X^2 = 324$, $p < 0.0001$). Mean length increased from spring to summer, an indication of juvenile growth, and decreased from summer to fall, due to the recruitment of YOY (Figure 6). The mean length of Atlantic menhaden was greatest in collections in Onslow Bay, where few individuals were taken (Figure 7). The length-frequency distributions of Atlantic menhaden in the SAB were numerically dominated by individuals taken in spring when few large specimens were taken.

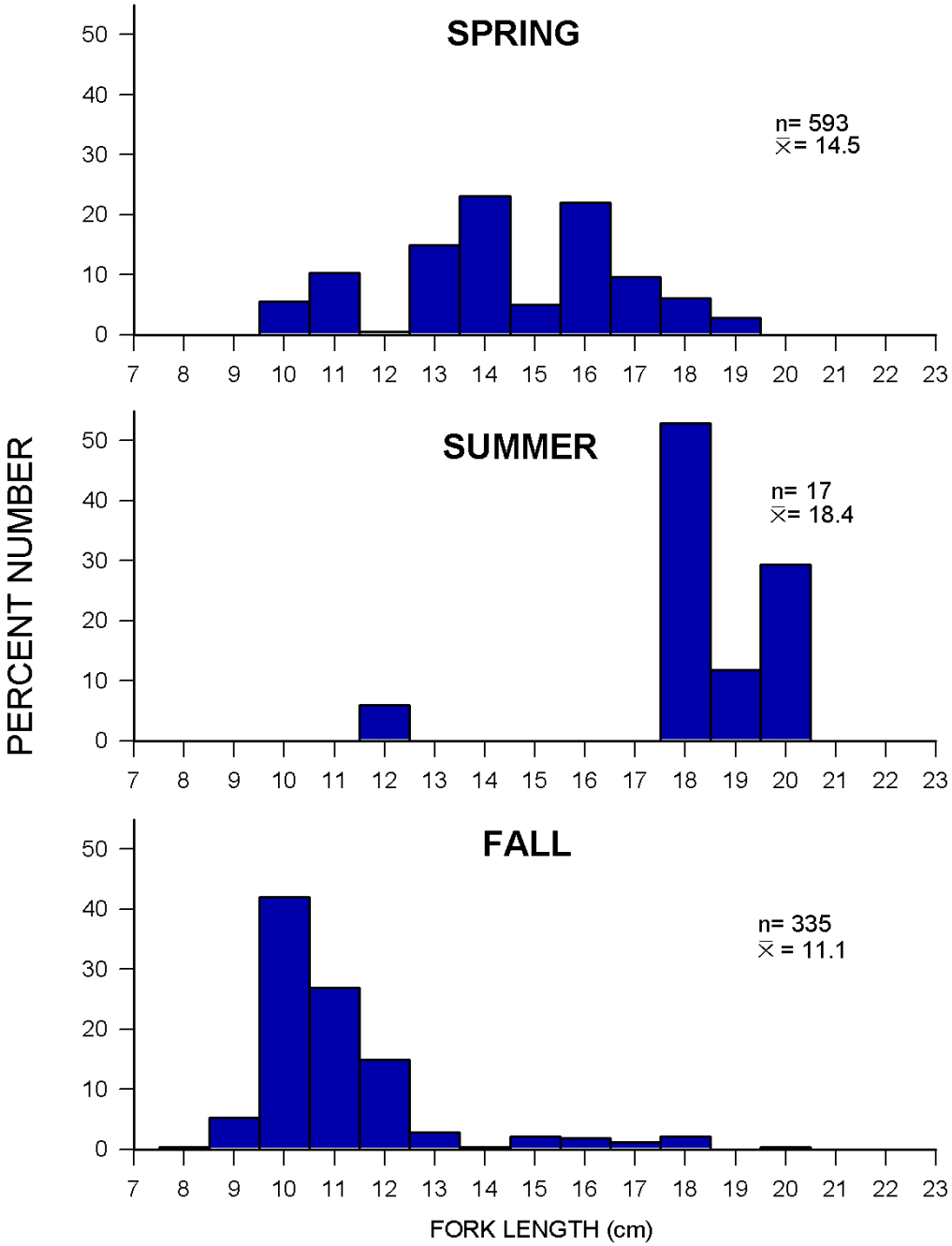

Figure 6. Seasonal length-frequencies of *Brevoortia tyrannus* in 2004.

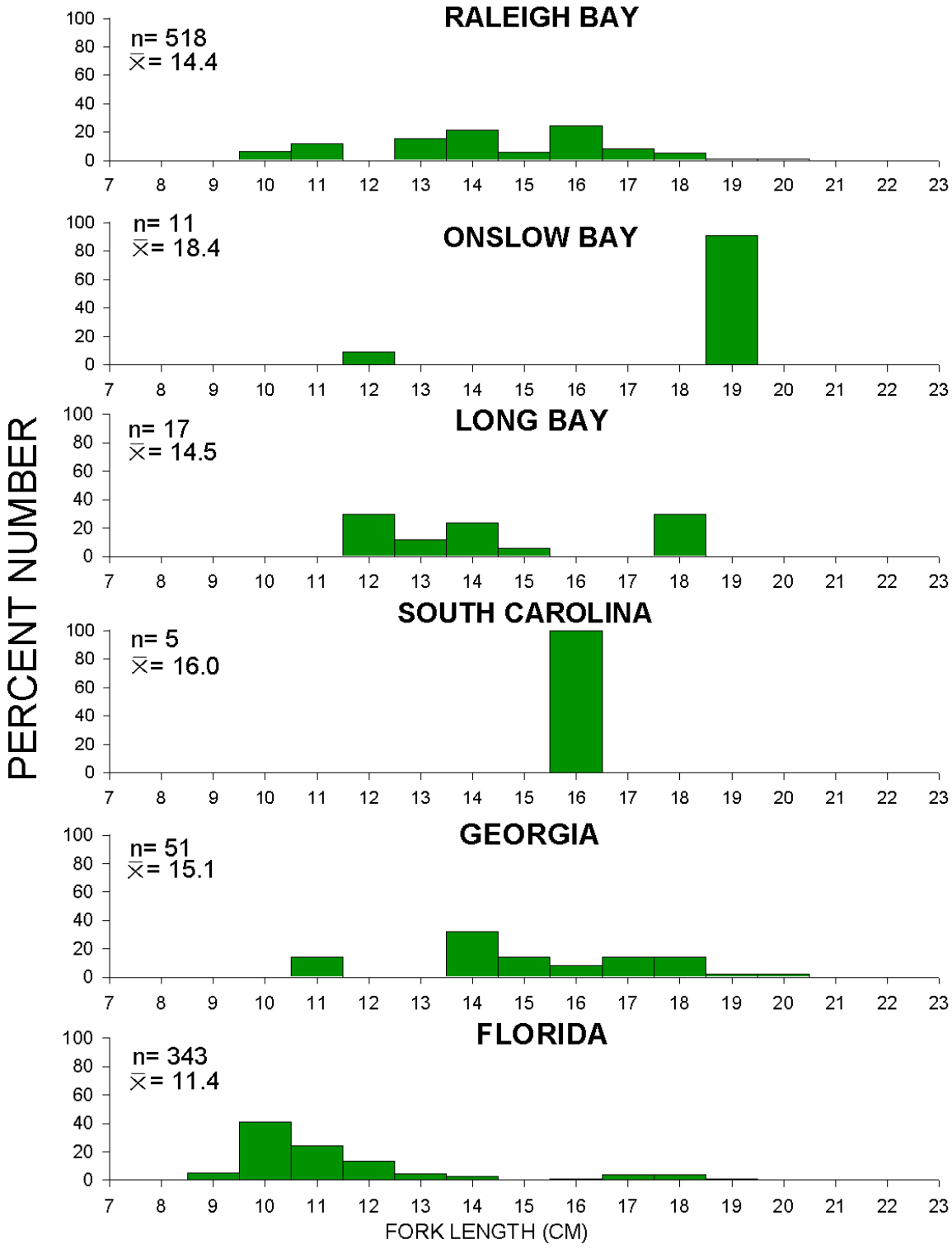

Figure 7. Regional length-frequencies of *Brevoortia tyrannus* in 2004

Centropristis striata

A total of 162 black sea bass (CV=5.1; 0.1 individuals/ha), weighing 8 kg (0.007 kg/ha), were collected in 2004. The density of abundance in 2004 represented an increase over the density observed in 2003 (Figure 8). Black sea bass were taken in all regions; however, density was greatest in Onslow Bay (Table 7). Total lengths of *Centropristis striata* ranged from 7 to 25 cm ($\bar{x}$ = 14.1).

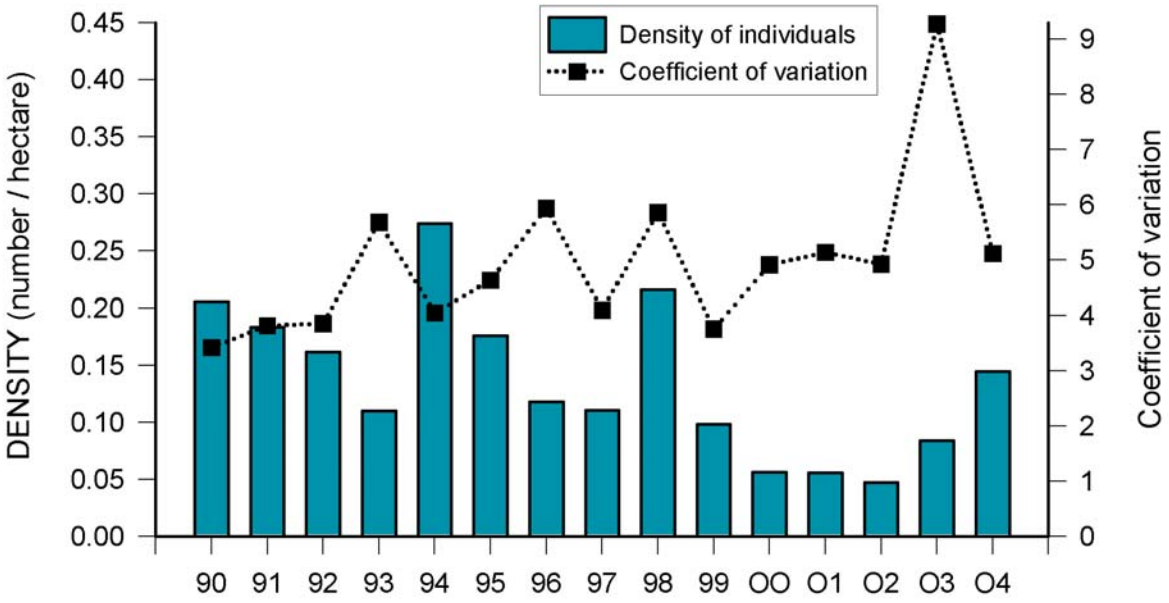

Figure 8. Annual densities of *Centropristis striata*

Table 7 . Estimates of density (number of individuals/hectare) in 2004.

Centropristis striata

	Spring	Summer	Fall	Region
Raleigh Bay	0	0.1	0	0.05
Onslow Bay	0.2	0.8	0.2	0.4
Long Bay	0.2	0.5	0.3	0.3
South Carolina	0.02	0	0.02	0.01
Georgia	0.01	0.01	0	0.007
Florida	0.2	0.08	0.03	0.1
Season	0.1	0.2	0.09	0.1

Chaetodipterus faber

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 466 Atlantic spadefish (CV=4.1; 0.4 individuals/ha), weighing 20 kg (0.02 kg/ha). Density of individuals peaked in 1991, with a general decline in abundance in subsequent years to the lowest level of abundance observed in 2001 (Figure 9). Atlantic spadefish density decreased slightly from 2002 to 2004. Density was greatest in fall (Table 8). Atlantic spadefish were most abundant in Raleigh Bay. Total lengths of *Chaetodipterus faber* ranged from 4 to 17 cm ($\bar{x}$ = 9.2).

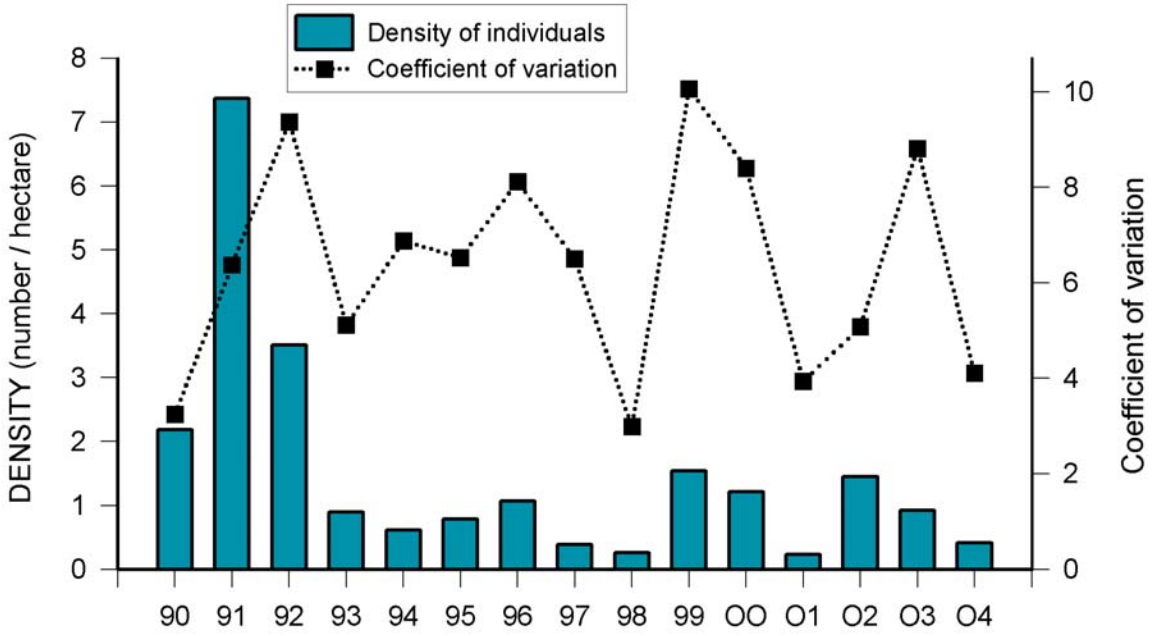

Figure 9. Annual densities of *Chaetodipterus faber*

Table 8 . Estimates of density (number of individuals/hectare) in 2004.

Chaetodipterus faber

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	4.3	1.5
Onslow Bay	0	0	1.1	0.4
Long Bay	0	0	0.6	0.2
South Carolina	0	0.05	0.1	0.05
Georgia	0.01	0.1	1.7	0.6
Florida	0.06	0	0.3	0.1
Season	0.01	0.03	1.2	0.4

Cynoscion nebulosus

The spotted seatrout, *Cynoscion nebulosus*, has been a rare species in SEAMAP-SA Shallow Water Trawl Survey collections (Figure 10). In the history of the trawl survey only nine specimens have been collected, all in shallow strata. No spotted seatrout were collected in 2004.

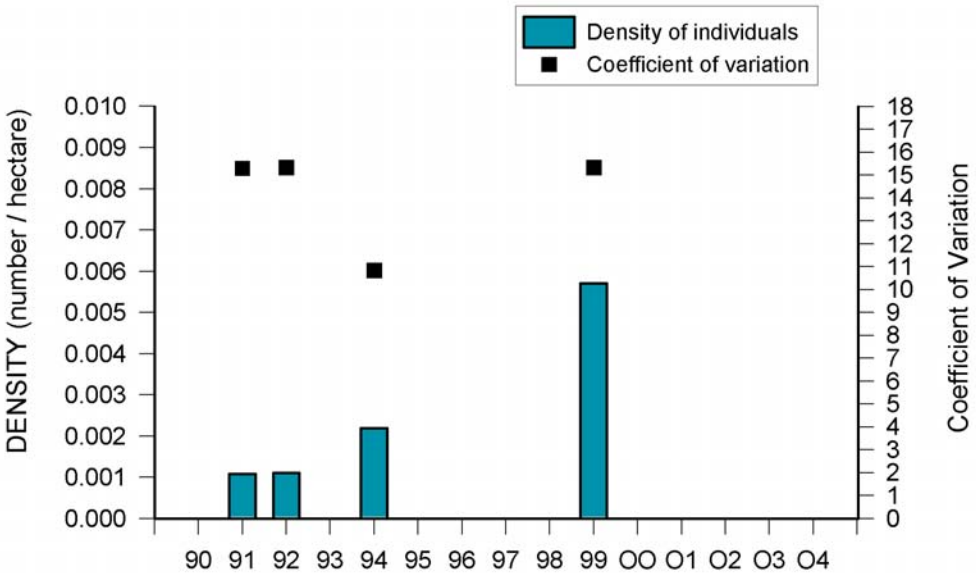

Figure 10. Annual densities of *Cynoscion nebulosus*

Cynoscion regalis

In 2004, SEAMAP strata yielded a total of 18,818 weakfish (CV=6.1; 16.8 individuals/ha), weighing 1152 kg (1.0 kg/ha). The density of abundance in 2004 represented the greatest annual density in the history of the survey (Figure 11). In 2004, density was greatest in spring and decreased in subsequent seasons (Table 9). Weakfish were most abundant in the northern portion of the SAB, with greatest density of individuals found in Raleigh Bay.

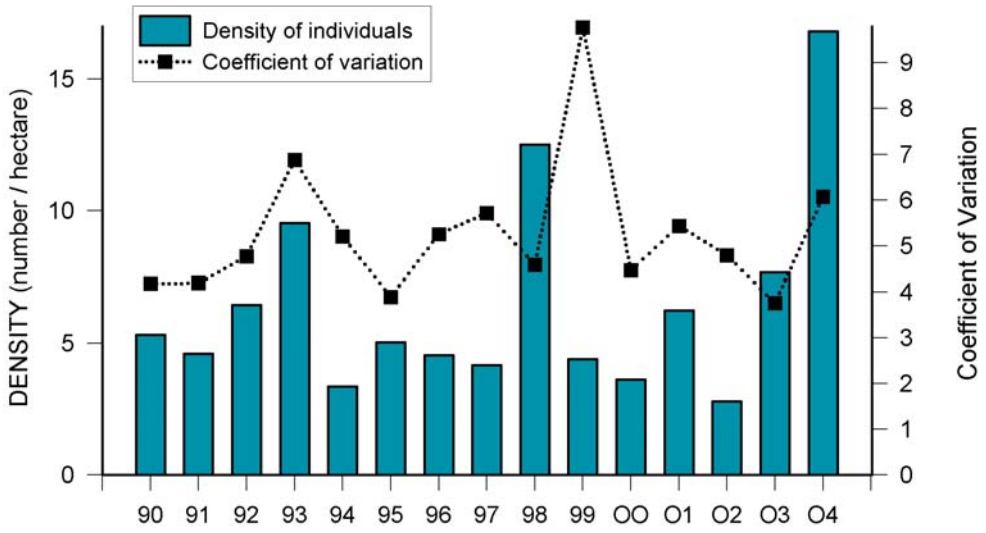

Figure 11. Annual densities of *Cynoscion regalis*

Table 9 . Estimates of density (number of individuals/hectare) in 2004.

Cynoscion regalis

	Spring	Summer	Fall	Region
Raleigh Bay	264.9	104.6	30.0	129.4
Onslow Bay	33.9	8.0	2.0	14.7
Long Bay	2.5	1.0	1.2	1.6
South Carolina	2.6	1.1	1.0	1.6
Georgia	2.0	0.7	3.7	2.2
Florida	0.7	1.7	1.6	1.3
Season	31.7	13.3	5.0	16.8

A total of 567 otolith (spring=246, summer=141, fall=180) and 109 gonad samples from weakfish were taken in 2004. The majority of the weakfish sampled were ages 0 (34%) and 1 (58%), followed by age 2 (8%), and age 3 (<1%). Weakfish collected in SEAMAP trawl samples ranged from 56 to 247 mm TL for age 0 fish, 101 to 327 mm TL for age 1, 215 to 357 mm TL for age 2, and 270 to 371 mm TL for age 3 individuals. No specimens older than age 3 were taken in SEAMAP trawl samples.

Total lengths of *Cynoscion regalis* ranged from 7 to 27 cm ($\bar{x}$ = 18.2). Length was significantly different among seasons (X^2 = 1084, p < 0.0001). Mean length increased from spring to fall as the result of subsequent juvenile growth (Figure 12). The percentage of age 0 fish increased seasonally from none in spring to 47% in summer and to 69% of the fish sampled in fall. The spring length-frequency distribution comprised mostly age 1 fish (90%). The inclusion of smaller specimens in summer collections resulted in a length-frequency distribution representing mostly age 1 fish that were spawned late and age 0 specimens.

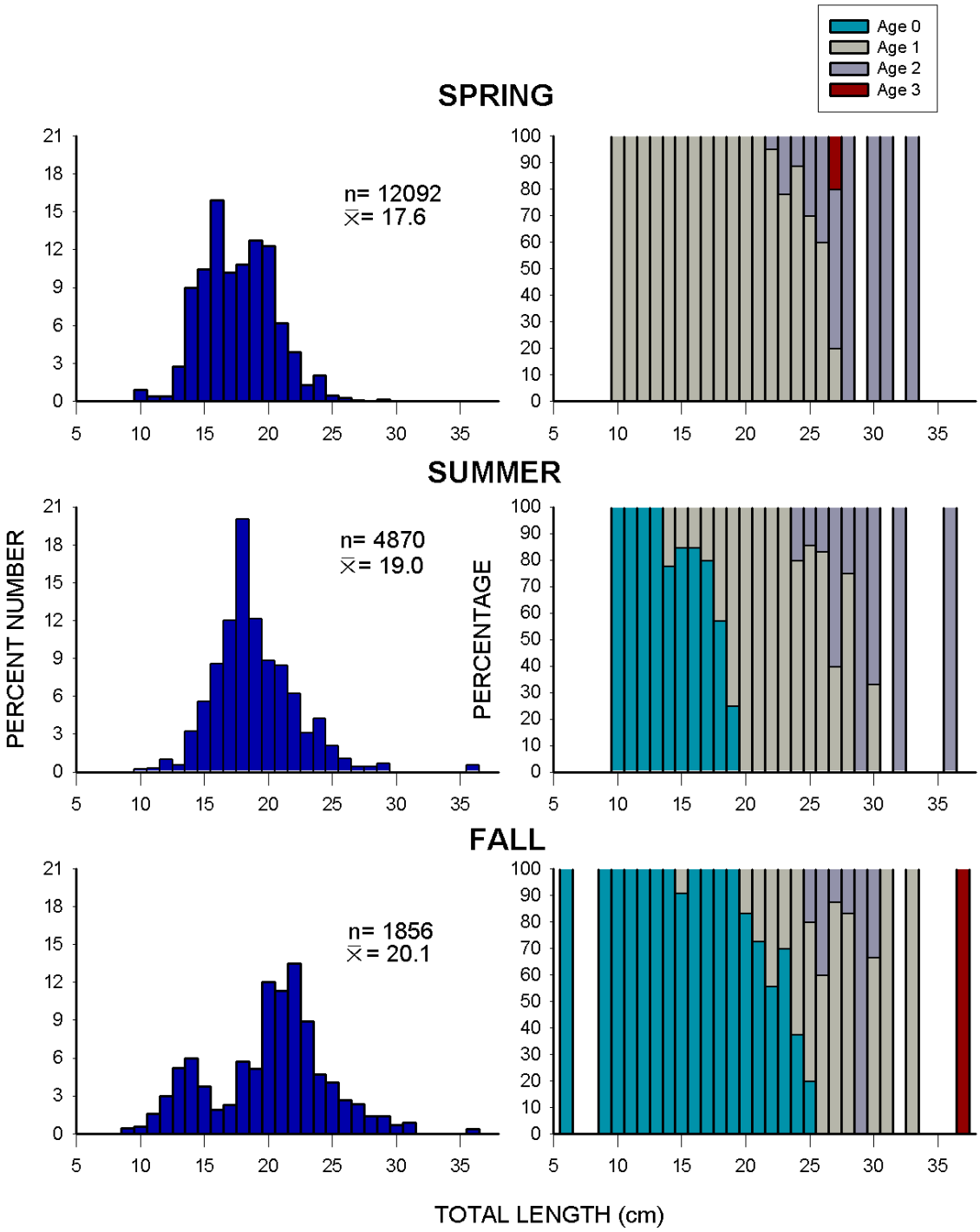

Figure 12. Seasonal length-frequencies and age composition of *Cynoscion regalis* in 2004.

Mean length also varied significantly among regions ($X^2 = 2244$, $p < 0.0001$), with larger mean lengths occurring in Onslow Bay (Figure 13). In all regions, the majority of specimens caught in spring were determined to be age 1. In the northern SAB, most individuals were age 0 in summer and age 1 in fall. In the southern SAB, weakfish were predominately age 1 in summer and age 0 in fall.

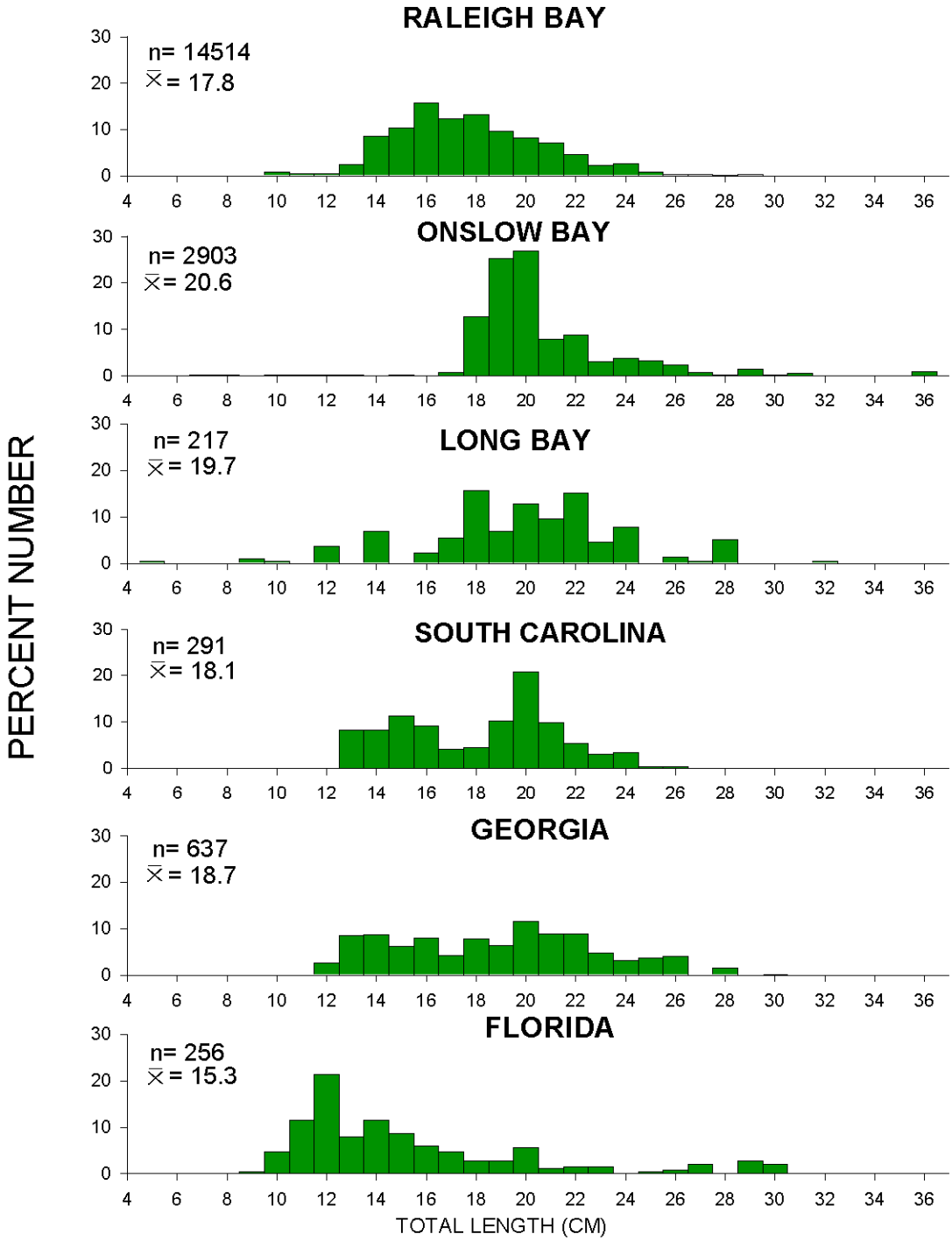

Figure 13. Regional length-frequencies of *Cynoscion regalis* in 2004

Leiostomus xanthurus

Leiostomus xanthurus was the third most abundant species collected in SEAMAP-SA trawl samples in 2004. The 69,223 (CV=3.7; 61.8 individuals/ha) spot collected weighed 3,667 (3.3 kg/ha) and constituted 11% of the total number of individuals taken in SEAMAP trawls in 2004. Density of individuals decreased in 2004 (Figure 14). In 2004, the greatest seasonal density of abundance occurred in spring and decreased in subsequent seasons (Table 10). The greatest regional densities were observed in the Raleigh and Onslow Bays.

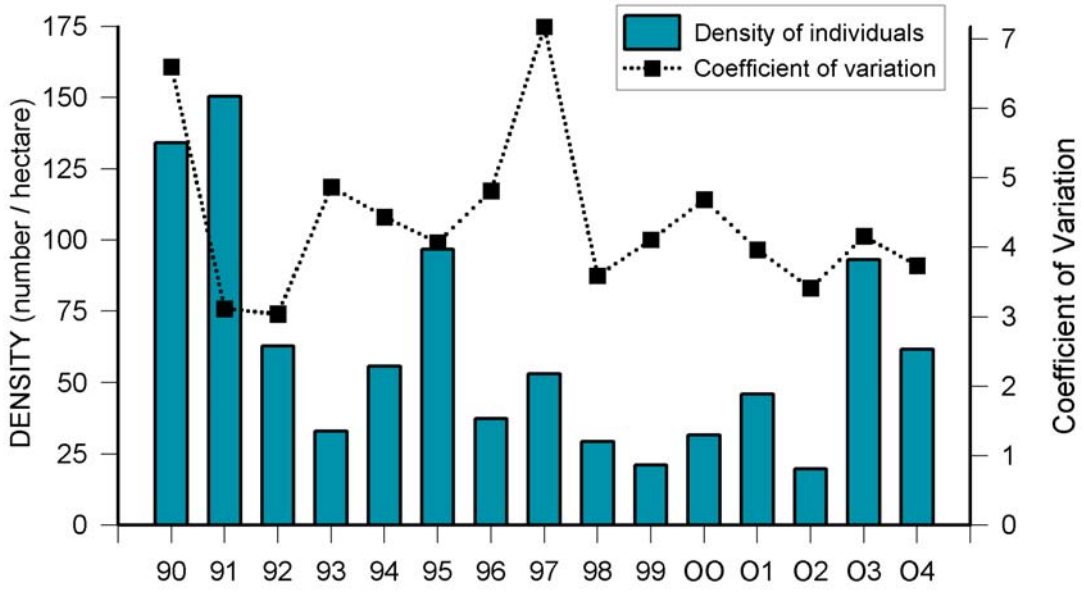

Figure 14. Annual densities of *Leiostomus xanthurus*

Table 10 . Estimates of density (number of individuals/hectare) in 2004.

Leiostomus xanthurus

	Spring	Summer	Fall	Region
Raleigh Bay	231.3	117.6	89.5	143.7
Onslow Bay	353.5	90.5	51.8	165.6
Long Bay	87.6	52.1	7.4	48.7
South Carolina	17.9	27.5	3.0	16.1
Georgia	1.2	9.4	2.7	4.3
Florida	56.8	81.1	0.6	47.5
Season	107.0	56.6	20.6	61.8

Total centerline lengths of spot from the SEAMAP-SA survey ranged from 7 to 27 cm, with a mean length of 14.6 cm. Lengths varied significantly among seasons ($X^2 = 7812$, $p < 0.0001$). Mean length decreased from spring to summer due to the recruitment of YOY, and increased from summer to fall, the result of juvenile growth (Figure 15). Length also varied significantly among regions ($X^2 = 5246$, $p < 0.0001$). The mean length of spot was greatest in waters off Florida (Figure 16). The length-frequency distribution of spot represents primarily specimens captured in Raleigh and Onslow Bays in all seasons.

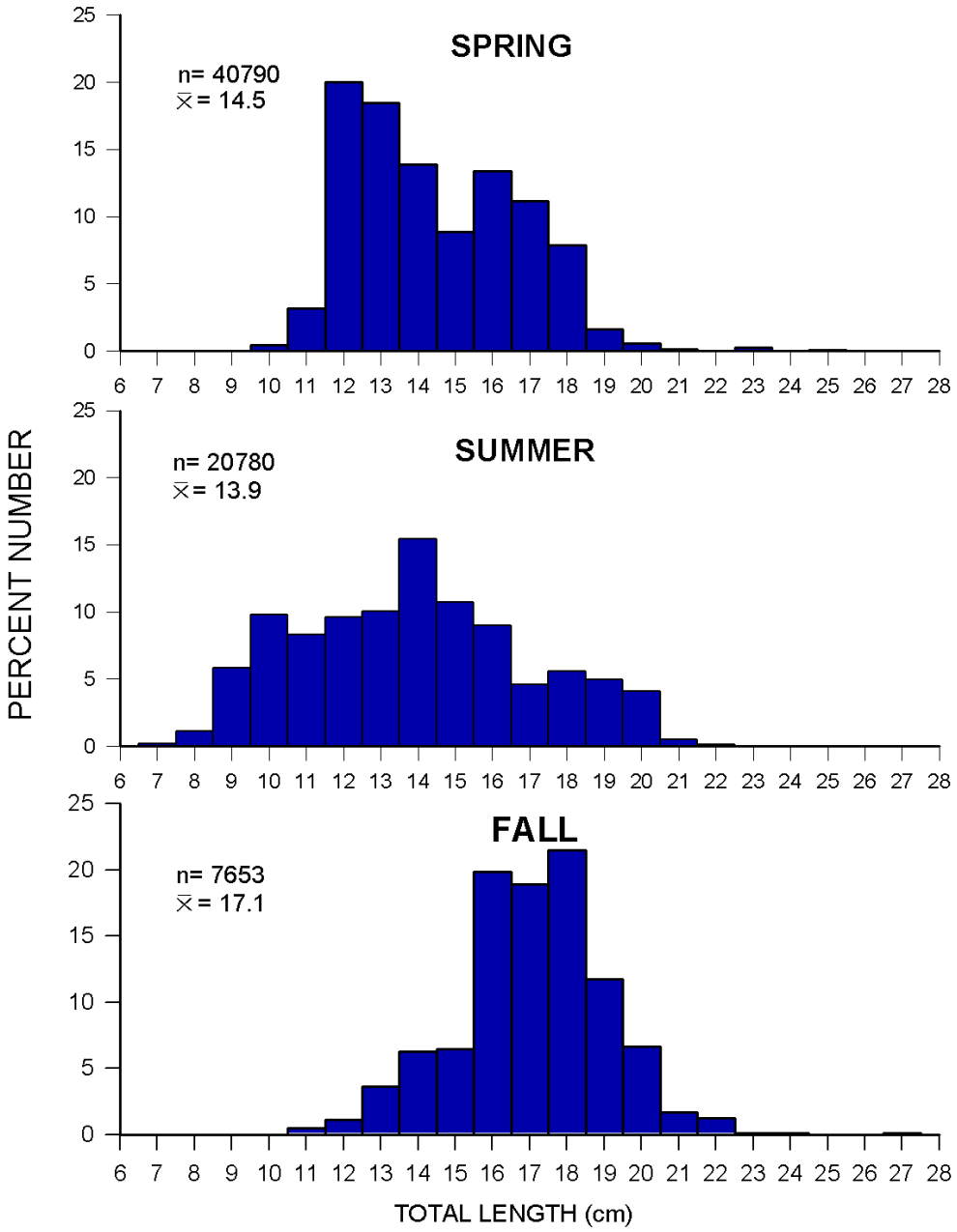

Figure 15. Seasonal length-frequencies of *Leiostomus xanthurus* in 2004

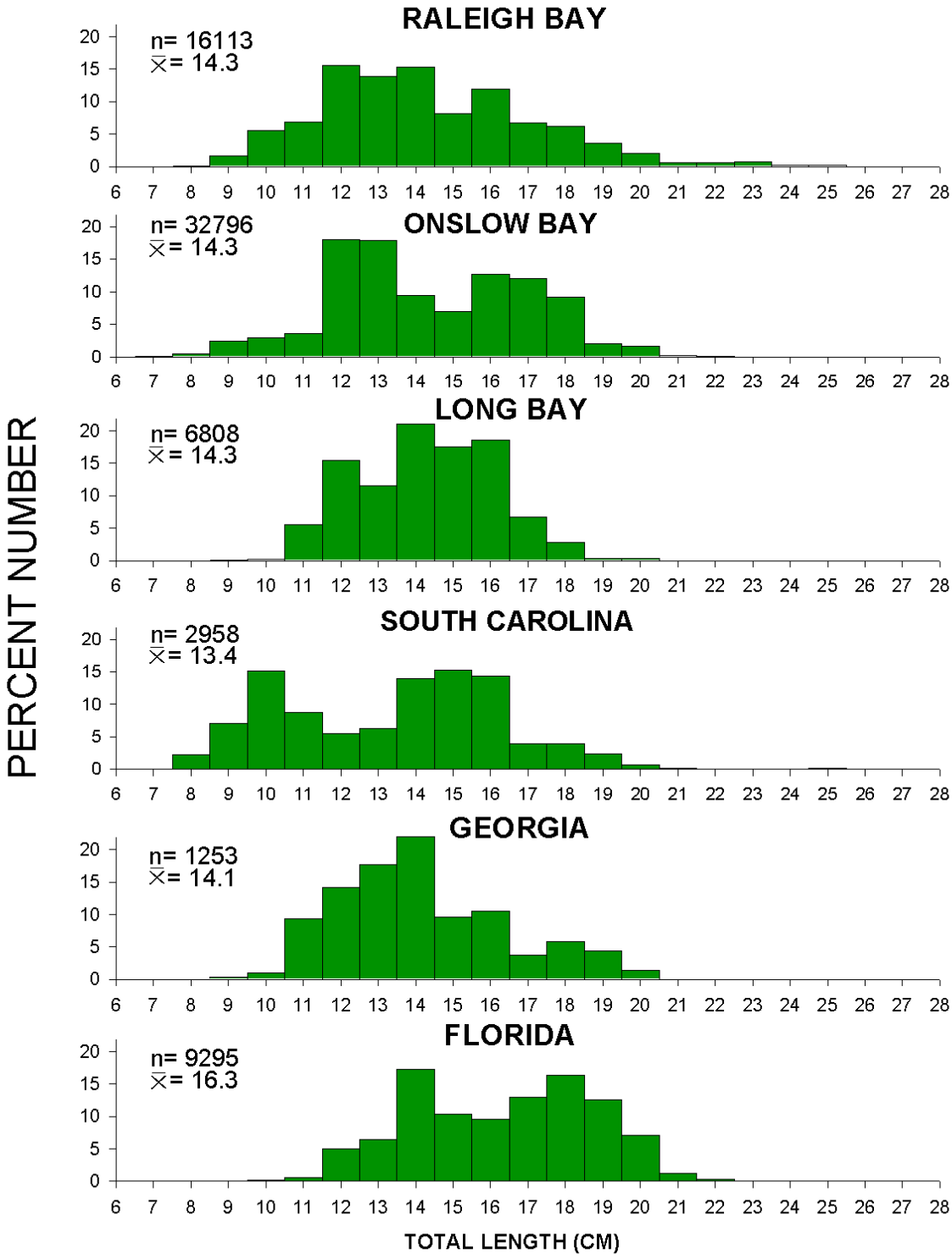

Figure 16. Regional length-frequencies of *Leiostomus xanthurus* in 2004

Menticirrhus americanus

SEAMAP-SA Shallow Water Trawl Survey strata produced a total of 20,394 southern kingfish (CV=2.8; 18.2 individuals/ha), weighing 1828 kg (1.6 kg/ha). In 2004, density of individuals reached the greatest level yet observed by the survey (Figure 17). Density was greatest in spring and in Raleigh Bay (Table 11). The southern kingfish exhibited the highest percent occurrence of all priority species, being present in approximately 86% of all tows.

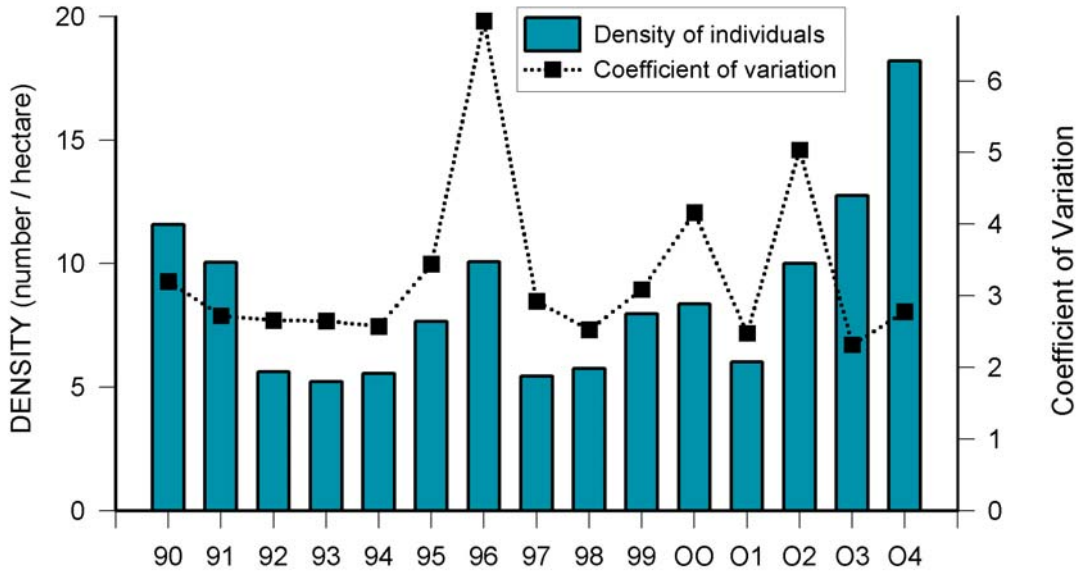

Figure 17. Annual densities of *Menticirrhus americanus*

Table 11 . Estimates of density (number of individuals/hectare) in 2004.

Menticirrhus americanus

	Spring	Summer	Fall	Region
Raleigh Bay	110.3	30.6	40.1	58.8
Onslow Bay	26.6	3.6	8.0	12.7
Long Bay	24.5	6.8	2.1	11.1
South Carolina	11.4	4.6	23.7	13.3
Georgia	7.2	8.0	9.2	8.1
Florida	22.0	46.5	5.8	25.2
Season	25.6	15.7	13.1	18.2

In 2004, a total of 1578 otoliths (spring=617, summer=420, fall=541) and 151 gonad samples were taken from southern kingfish. Southern kingfish of age 1 constituted the largest percentage (41%) of the individuals sampled, followed by age 0 (27%), age 2 (22%), age 3 (8%), age 4 (1%), and age 5 (<1%). Only two specimens of age 6 were sampled. *Menticirrhus americanus* ranged from 74 to 265 mm TL for age 0, from 94 to 287 mm TL for age 1, from 190 to 345 for age 2, from 237 to 372 mm TL for age 3, from 254 to 381 mm TL for age 4, and from 272 to 340 mm TL for age 5. Two age 6 individuals (236 and 316 cm) were taken in SEAMAP trawl samples.

Total lengths of *Menticirrhus americanus* ranged from 6 to 37 cm ($\bar{x}$ = 19.7). Length was significantly different among seasons ($X^2 = 404$, $p < 0.0001$). Mean length decreased from spring to summer, indicating the recruitment of YOY individuals, and decreased in fall, the result of subsequent juvenile growth (Figure 18). The percentage of age 0 fish increased from none in spring to 27% in summer and to 57% of the southern kingfish sampled in fall. The spring length-frequency distribution comprised mostly age 1 fish. The inclusion of smaller specimens in summer and fall collections resulted in a length-frequency distribution representing mostly age 1 fish that were spawned late and age 0 specimens.

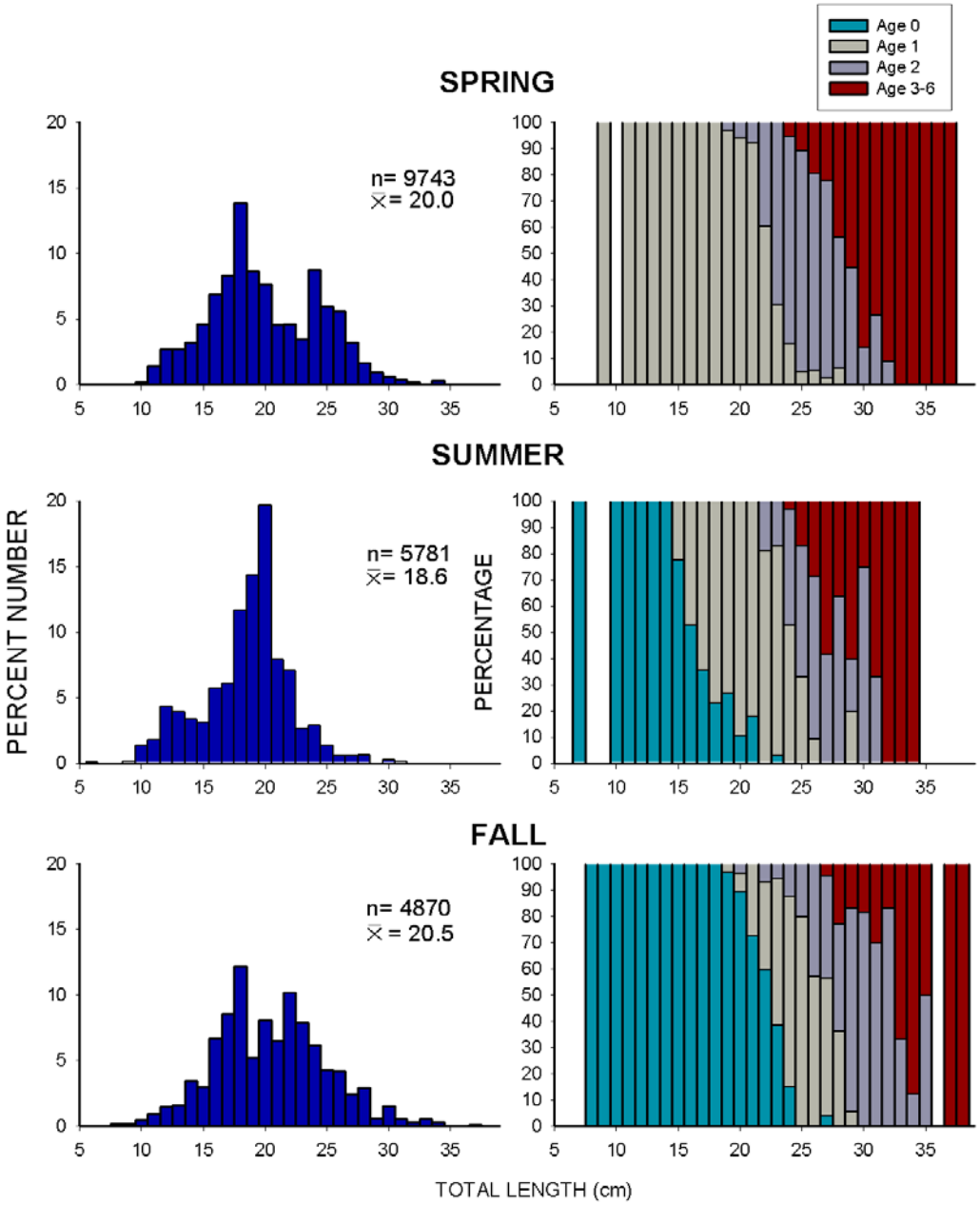

Figure 18. Seasonal length-frequencies and age composition of *Menticirrhus americanus* in 2004

Length also varied significantly among regions ($X^2 = 3304$, $p < 0.0001$), with greatest mean length observed in Onslow Bay (Figure 19). In all regions, age 1 individuals made up the greatest percentage of the population in spring and summer, whereas fall trawls produced individuals that were primarily age 0.

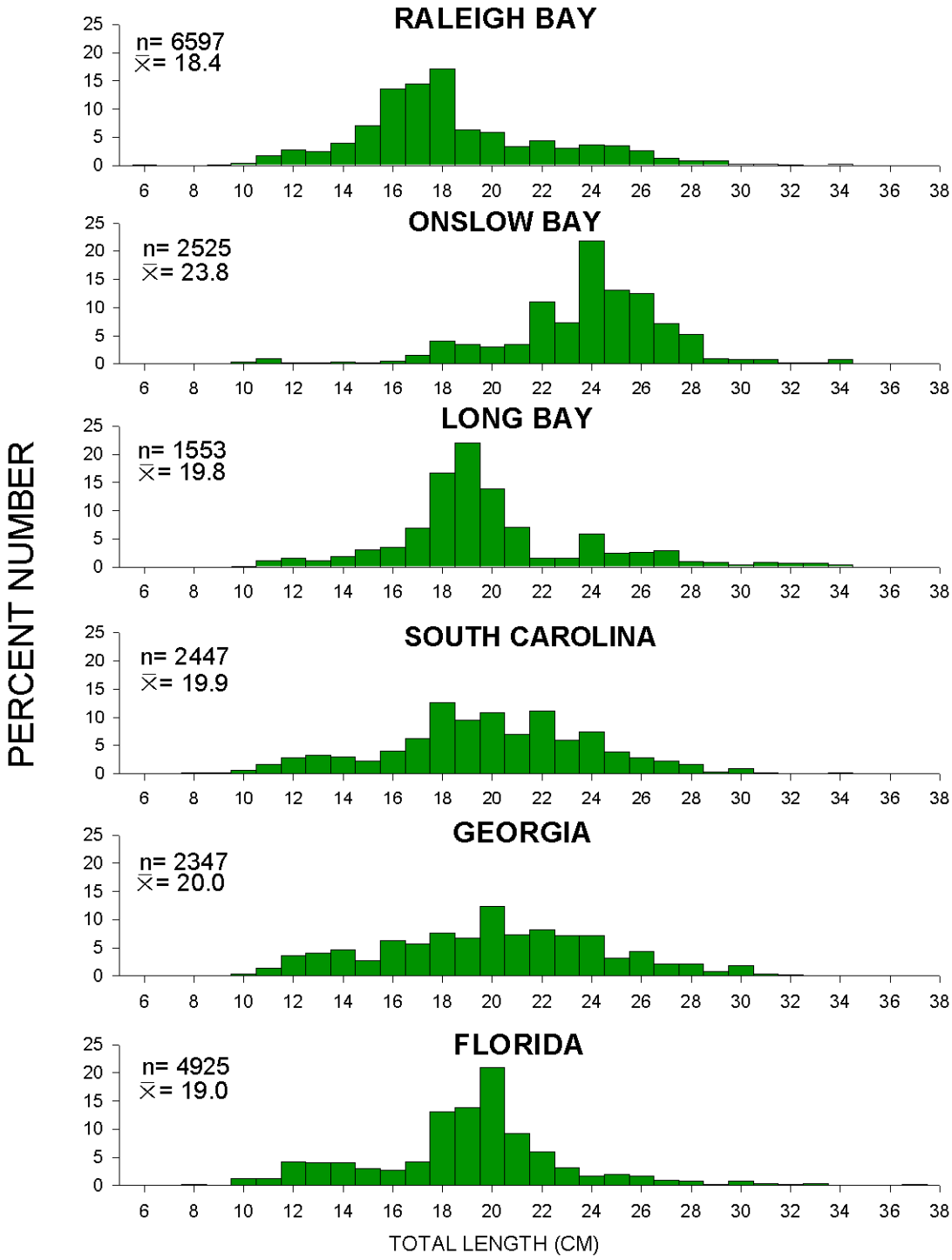

Figure 19. Regional length-frequencies of *Menticirrhus americanus* in 2004

Menticirrhus littoralis

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 719 gulf kingfish (CV=4.3; 0.6 individuals/ha), weighing 94 kg (0.08 g/ha) in 2004. Density of individuals for *Menticirrhus littoralis* peaked in 2004 (Figure 20). Density was greatest in fall and Gulf kingfish were most abundant in the southern portion of the SAB, especially in Florida waters (Table 12). Total lengths of *Menticirrhus littoralis* ranged from 12 to 38 cm ($\bar{x}$ = 22.6), with greatest mean length in summer.

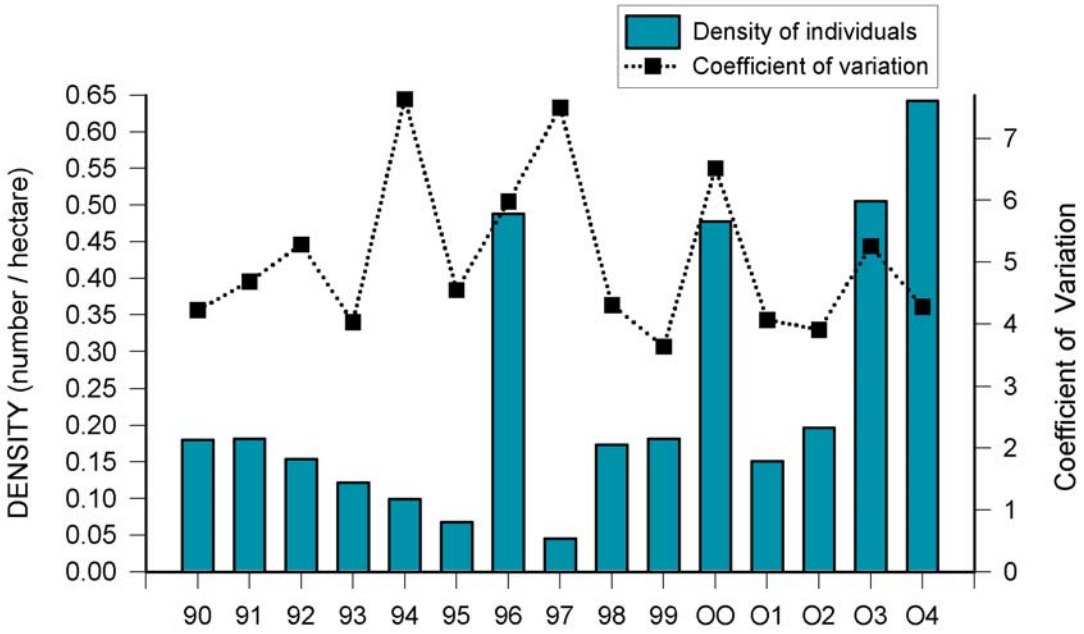

Figure 20. Annual densities of *Menticirrhus littoralis*

Table 12 . Estimates of density (number of individuals/hectare) in 2004.

Menticirrhus littoralis

	Spring	Summer	Fall	Region
Raleigh Bay	0	0.3	0	0.1
Onslow Bay	0	0.02	0	0.005
Long Bay	0	0	0.1	0.04
South Carolina	0.03	0.02	0.07	0.04
Georgia	0.08	0	0.08	0.06
Florida	1.6	1.4	7.7	3.4
Season	0.3	0.3	1.3	0.6

Menticirrhus saxatilis

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 149 northern kingfish (CV=9.0; 0.1 individuals/ha), weighing 22 kg (0.02 kg/ha) in 2004. Although density estimates increased in 2004, record density of individuals was observed in 2002 (Figure 21). Density was greatest in fall (Table 13). Northern kingfish were not taken in South Carolina or Georgia waters. Density of individuals was greatest in Raleigh and Onslow Bays. Total lengths of *Menticirrhus saxatilis* ranged from 14 to 34 cm ($\bar{x}$ = 24.2), with greatest mean length in spring and in Onslow Bay.

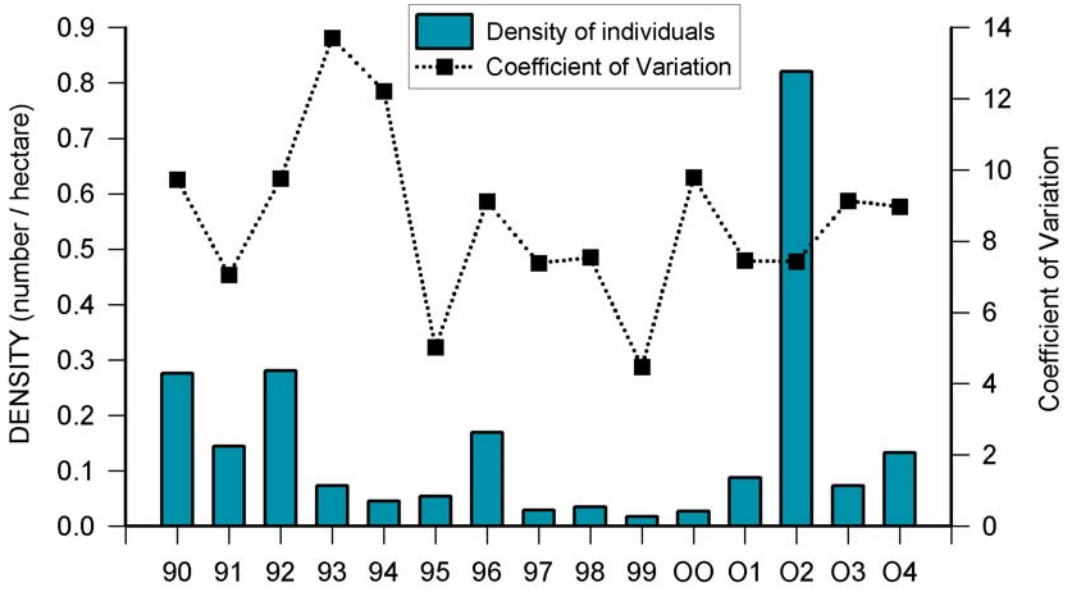

Figure 21. Annual densities of *Menticirrhus saxatilis*

Table 13 . Estimates of density (number of individuals/hectare) in 2004.

Menticirrhus saxatilis

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	3.3	1.1
Onslow Bay	0.3	0	0.02	0.1
Long Bay	0	0.04	0	0.01
South Carolina	0	0	0	0
Georgia	0	0	0	0
Florida	0	0.02	0	0.005
Season	0.05	0.008	0.3	0.1

Micropogonias undulatus

Micropogonias undulatus was the most abundant species collected by the SEAMAP-SA Shallow Water Trawl Survey in 2004. The 108,181 individuals (CV=3.5), weighing 7,464 kg, made up17% of the total number of specimens taken in SEAMAP strata. Density estimates for the entire SAB were 96.6 individuals/ha and 6.7 kg/ha, an increase from 2003 and exceeded only in the peak years of 1991-1992 (Figure 22). Seasonal densities of individuals were greatest in summer. Regional densities were highest in the northern portion of the SAB, primarily due to large catches of Atlantic croaker in summer (Table 14).

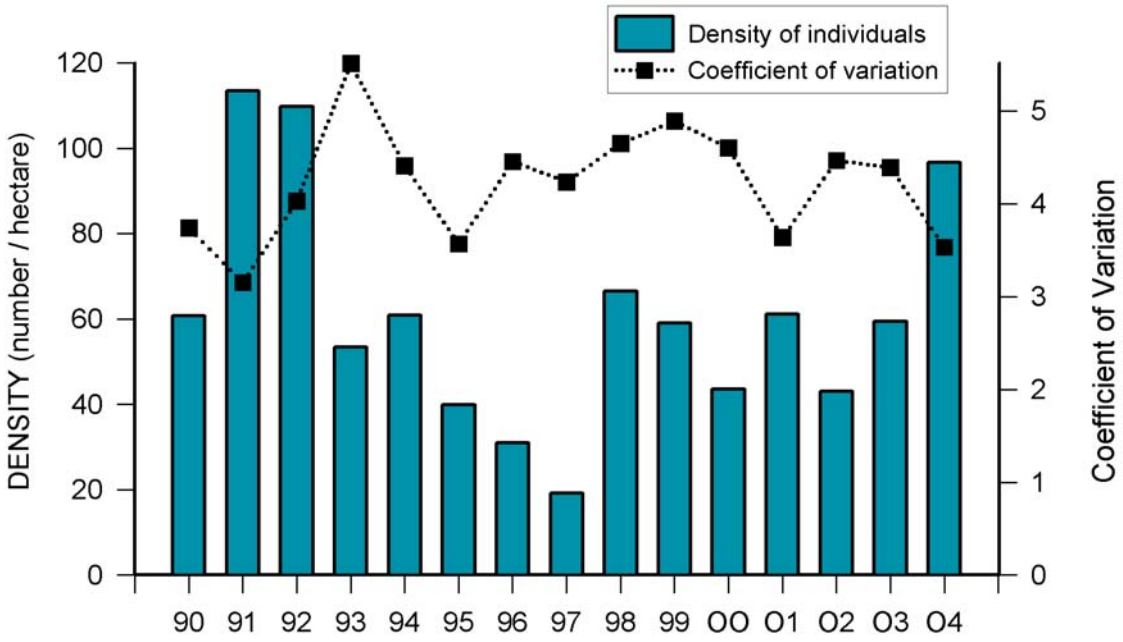

Figure 22. Annual densities of *Micropogonias undulatus*

Table 14. Estimates of density (number of individuals/hectare) in 2004.

Micropogonias undulatus

	Spring	Summer	Fall	Region
Raleigh Bay	57.1	458.1	439.6	326.0
Onslow Bay	39.5	375.9	80.1	166.1
Long Bay	71.7	307.6	63.3	145.6
South Carolina	0.05	18.0	4.9	7.5
Georgia	0.6	18.8	3.4	7.3
Florida	7.2	218.6	1.0	76.1
Season	22.4	201.1	69.5	96.6

In 2004, a total of 618 otolith (spring=139, summer=258, fall=221) and 126 gonad samples were taken from Atlantic croaker. The majority of the Atlantic croaker sampled were age 0 (48%) and age 1 (42%). Other age-classes included age 2 (8%), age 3 (2%), age 4 (<1%), and age 5 (<1%). Atlantic croaker ranged from 100 to 229 mm TL for age 0, from 113 to 236 mm TL for age 1, from 177 to 276 for age 2, from 217 to 255 mm TL for age 3, from 214 to 242 TL for age 4 individuals, and from 217 to 227 TL for age 5 individuals.

Total lengths of Atlantic croaker ranged from 9 to 28 cm ($\bar{x}$ = 17.6 cm). Lengths differed significantly among seasons (X^2 =1925, $p < 0.0001$), although mean length did not vary much seasonally (Figure 23). Seasonally, the percentage of age 0 fish increased from 18% in spring to 47% in summer and 67% in fall. The spring length-frequency distribution comprised mostly age 1 fish (67%). The inclusion of smaller specimens in summer collections resulted in a length-frequency distribution representing mostly age 0 (47%) and age 1 fish (41%), with ages 2-5 also present in trawl samples. In fall the majority of Atlantic croaker were age 0 (67%).

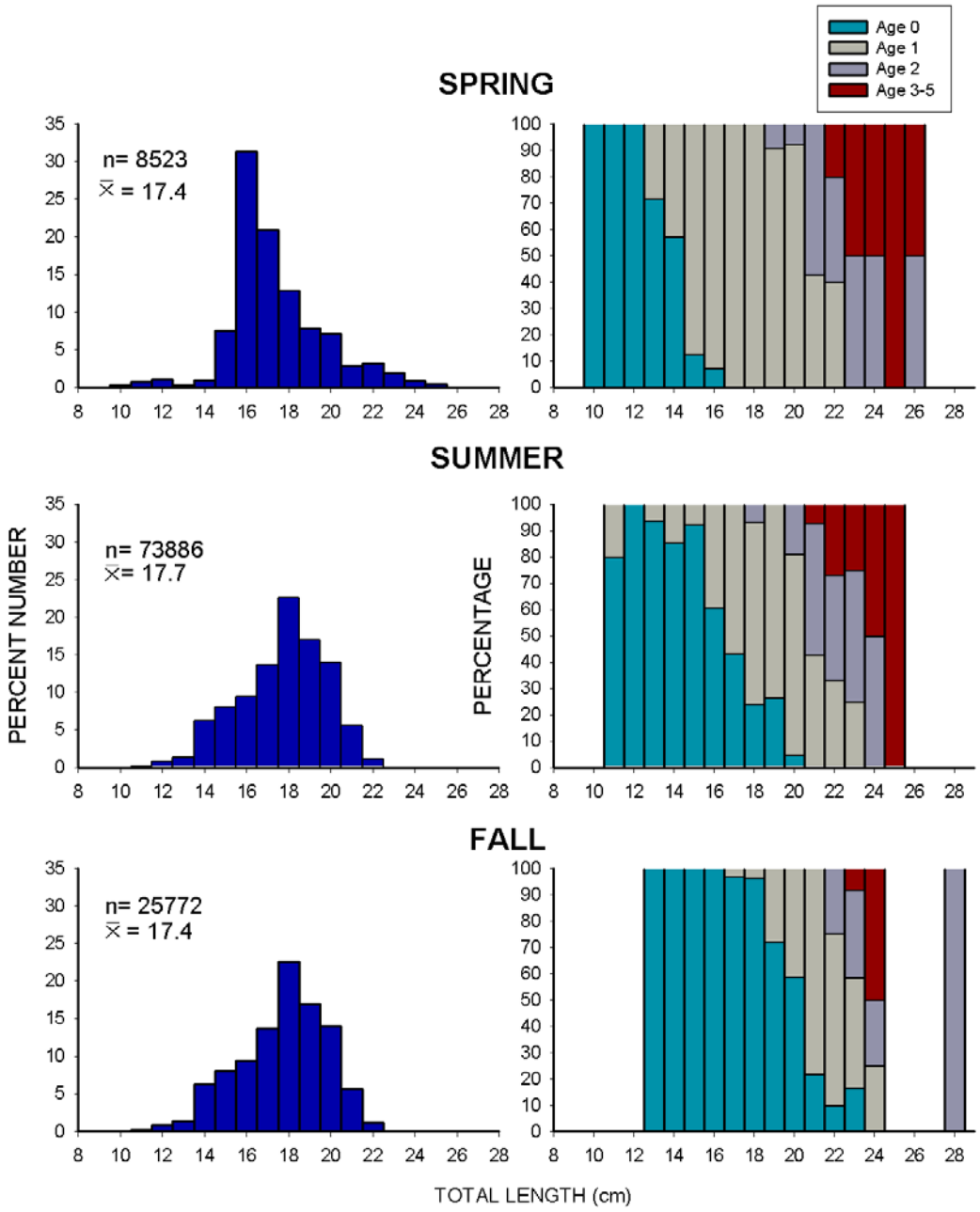

Figure 23. Seasonal length-frequencies and age composition of *Micropogonias undulatus* in 2004

Length also varied significantly among regions (X^2 =25684, $p < 0.0001$), and mean lengths ranged from 15.4 cm off South Carolina to 19.0 cm in Onslow Bay (Figure 24). In strata off North Carolina, age 1 made up the greatest percentage of the population, whereas in waters off South Carolina, Georgia, and Florida age 0 specimens were more numerous. Collections consisted of mostly age 0, age 1, and a few larger specimens.

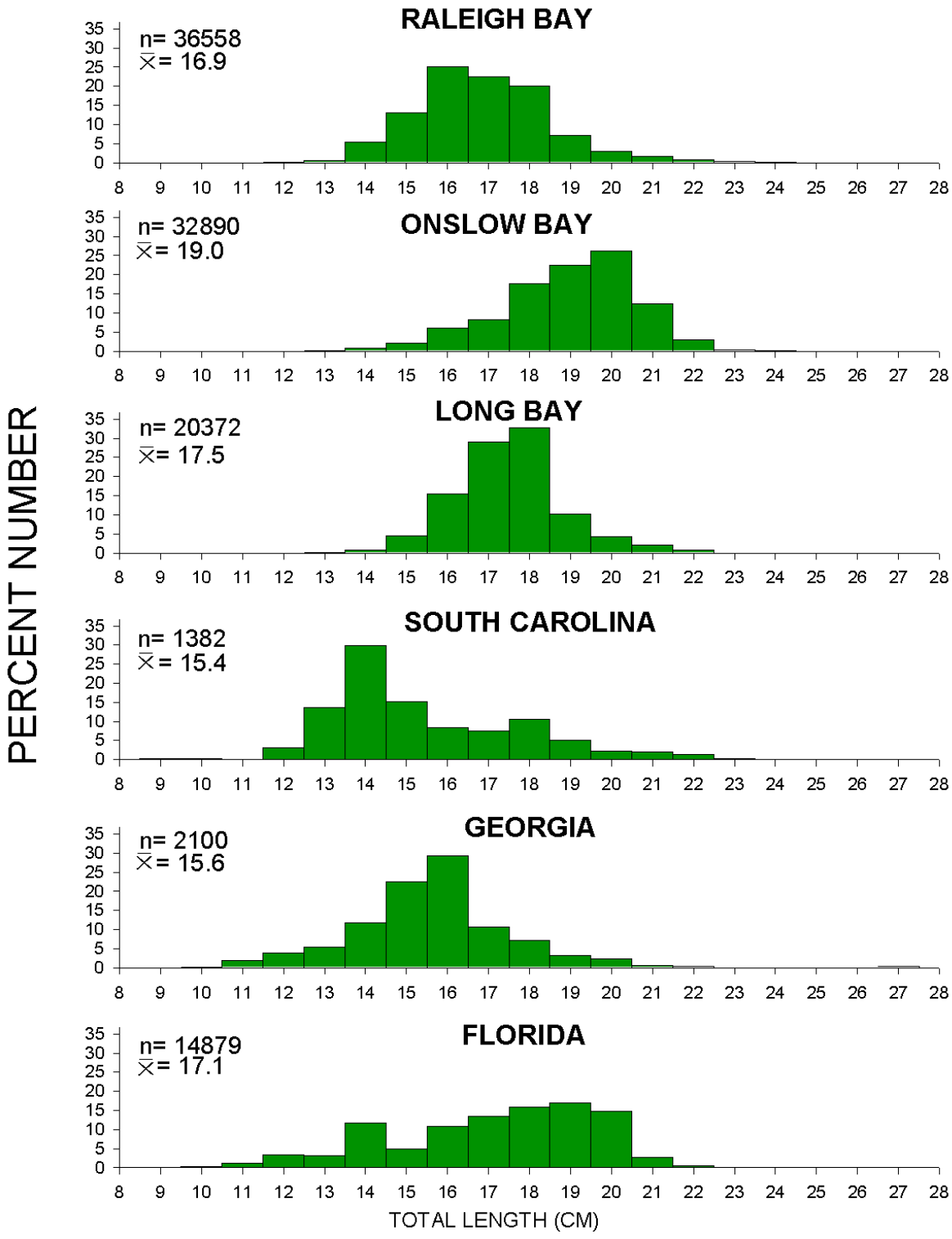

Figure 24. Regional length-frequencies of *Micropogonias undulatus* in 2004

Mycteroperca microlepis

The gag grouper, *Mycteroperca microlepis*, has been rare in SEAMAP-SA Shallow Water Trawl Survey collections (SEAMAP-SA/SCMRD, 2000). Only three individuals have been taken by the survey. No gag grouper were collected in 2004 (Figure 25).

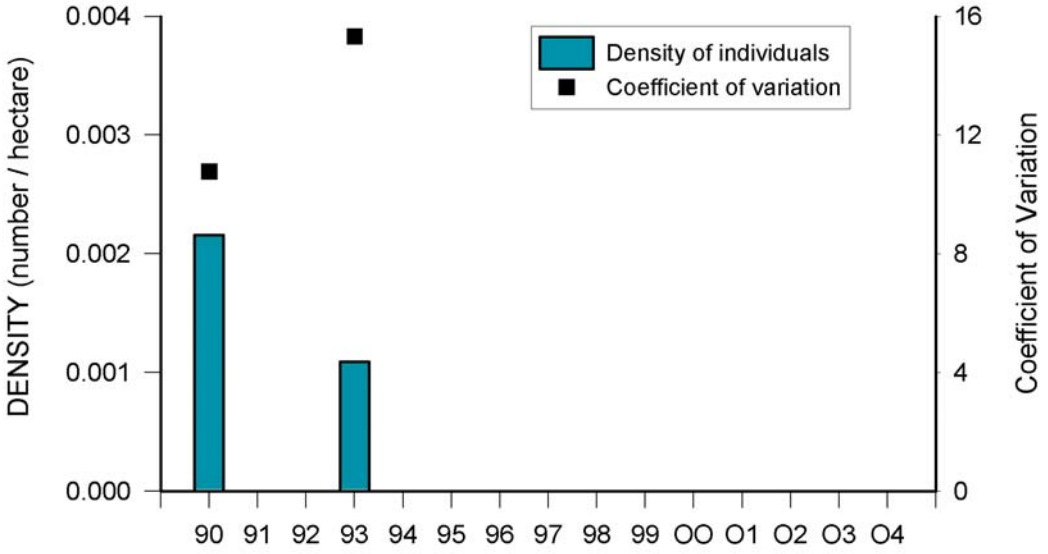

Figure 25. Annual densities of *Mycteroperca microlepis*

Paralichthys albigutta

The gulf flounder, *Paralichthys albigutta*, generally exhibits low abundance in SEAMAP-SA Shallow Water Trawl Survey collections. A total of 31 individuals (CV=8.4; 0.03 individuals/ha), weighing 11 kg (0.01 kg/ha), were taken in 2004. Density of abundance of gulf flounder was the third highest abundance recorded by the survey (Figure 26). Gulf flounder were most abundant in spring in Onslow Bay (Table 15). Lengths ranged from 18 to 43 cm ($\bar{x}$ = 29.8), with greatest mean length in spring and in Onslow Bay.

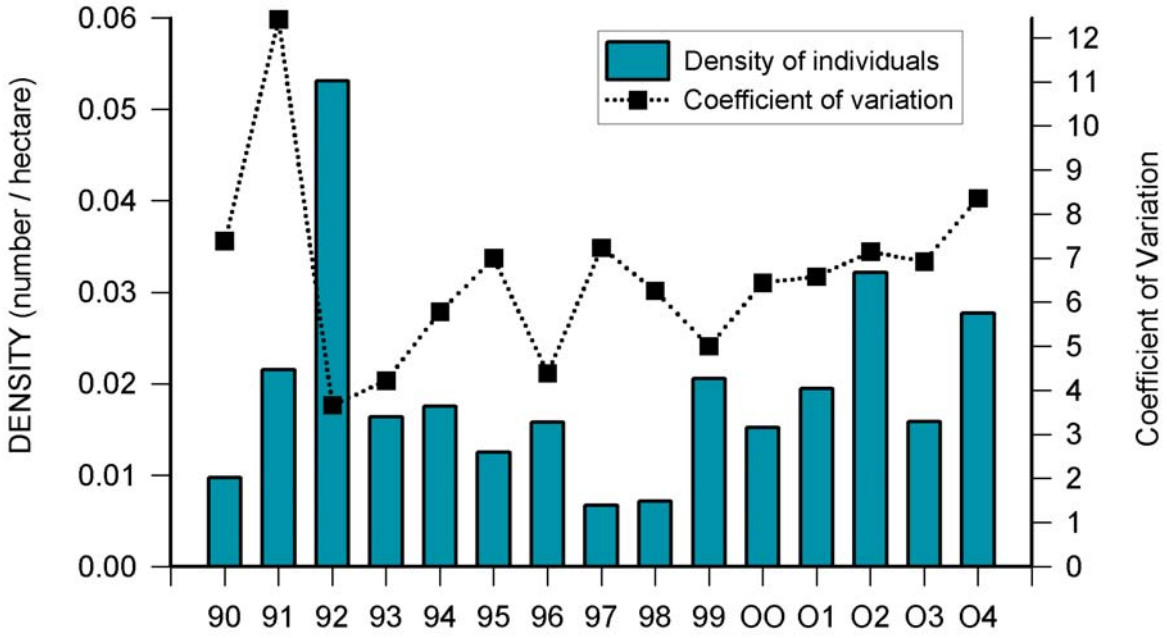

Figure 26. Annual densities of *Paralichthys albigutta*

Table 15. Estimates of density (number of individuals/hectare) in 2004.

Paralichthys albigutta

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0.05	0.03	0	0.03
Long Bay	0.02	0	0	0.007
South Carolina	0	0	0	0
Georgia	0	0	0.02	0.007
Florida	0.02	0.01	0	0.1
Season	0.05	0.02	0.005	0.03

Paralichthys dentatus

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 538 summer flounder (CV=3.0; 0.5 individuals/ha), weighing 85 kg (0.08 kg/ha). Although the density in 2004 did increase from the 2003 level of abundance, density of individuals has not varied much annually, with the exception of a peak in abundance in 1992 (Figure 27). Density was greatest in summer and fall (Table 16). Summer flounder were most abundant in the Raleigh Bay. Total lengths of *Paralichthys dentatus* ranged from 11 to 43 cm ($\bar{x}$ = 23.9). Seasonal mean length was lowest in summer when the majority of smaller specimens were taken. Greatest regional mean length occurred in Onslow Bay.

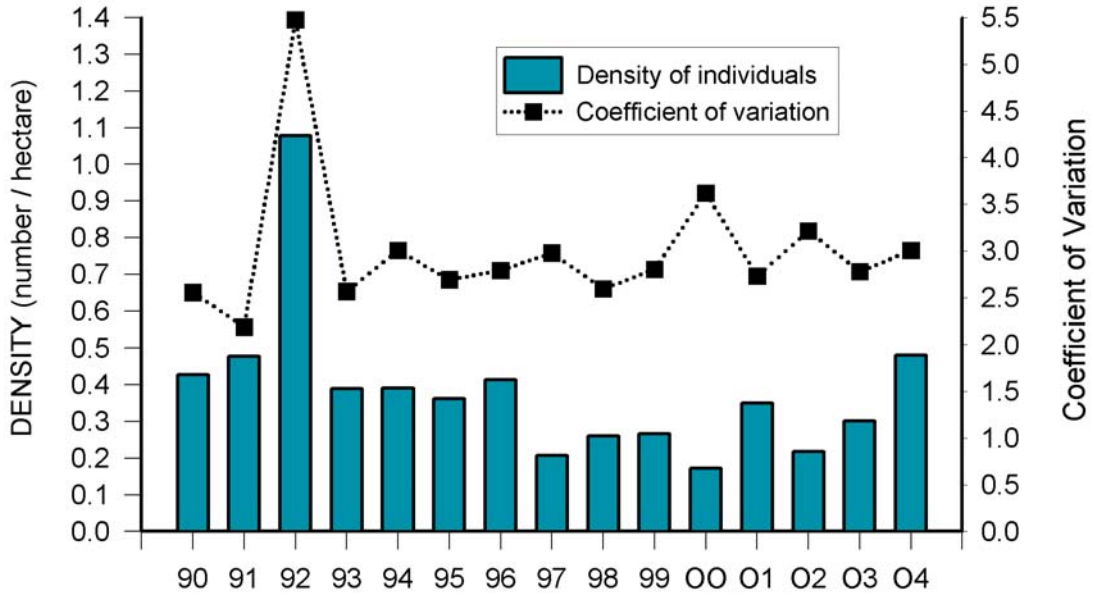

Figure 27. Annual densities of *Paralichthys dentatus*

Table 16. Estimates of density (number of individuals/hectare) in 2004.

Paralichthys dentatus

	Spring	Summer	Fall	Region
Raleigh Bay	0.03	3.0	1.8	1.6
Onslow Bay	0.3	0.2	1.3	0.6
Long Bay	0.02	0.04	0.2	0.07
South Carolina	0.1	0.7	0.9	0.6
Georgia	0.03	0.3	0.6	0.3
Florida	0	0.4	0.03	0.1
Season	0.09	0.6	0.8	0.5

Paralichthys lethostigma

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 126 southern flounder (CV=4.2; 0.1 individuals/ha), weighing 48 kg (0.04 kg/ha) in 2004. In 2004, density of individuals reached the greatest level yet observed by the survey (Figure 28). Seasonal densities did not vary a great deal (Table 17). Southern flounder were most abundant in the Raleigh Bay and Florida. Total lengths of *Paralichthys lethostigma* ranged from 16 to 46 cm ($\bar{x}$ = 31.4).

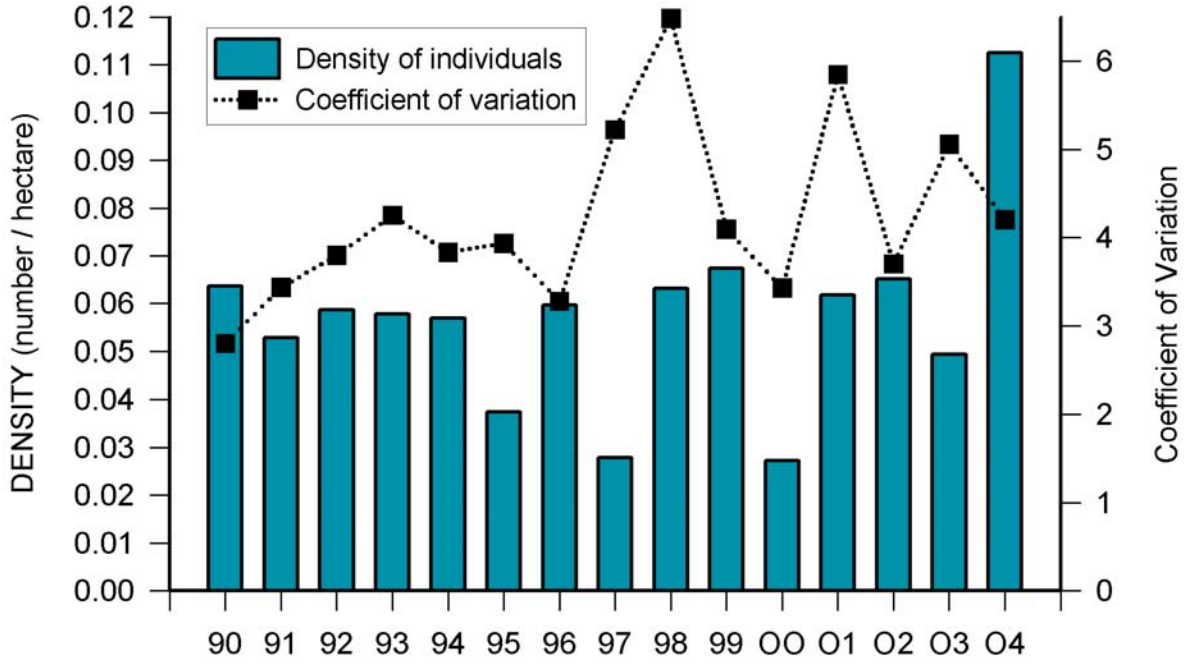

Figure 28. Annual densities of *Paralichthys lethostigma*

Table 17. Estimates of density (number of individuals/hectare) in 2004.

Paralichthys lethostigma

	Spring	Summer	Fall	Region
Raleigh Bay	0.3	0	0.5	0.3
Onslow Bay	0.02	0.08	0.2	0.08
Long Bay	0	0	0	0
South Carolina	0.08	0.03	0.2	0.1
Georgia	0.03	0.01	0.03	0.02
Florida	0.3	0.5	0.1	0.3
Season	0.1	0.1	0.1	0.1

Peprilus paru

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 3,319 *Peprilus paru* , previously referred to as *Peprilis alepidotus*, (CV=4.0; 3.0 individuals/ha), weighing 246 kg (0.2 kg/ha). Density of individuals in 2004 represents an increase in abundance from 2003 (Figure 29). Annual peaks in abundance reflect large catches of harvestfish in fall collections (SEAMAP-SA/SCMRD, 2000). In 2004, harvestfish were most abundant in Raleigh Bay in the fall (Table 18).

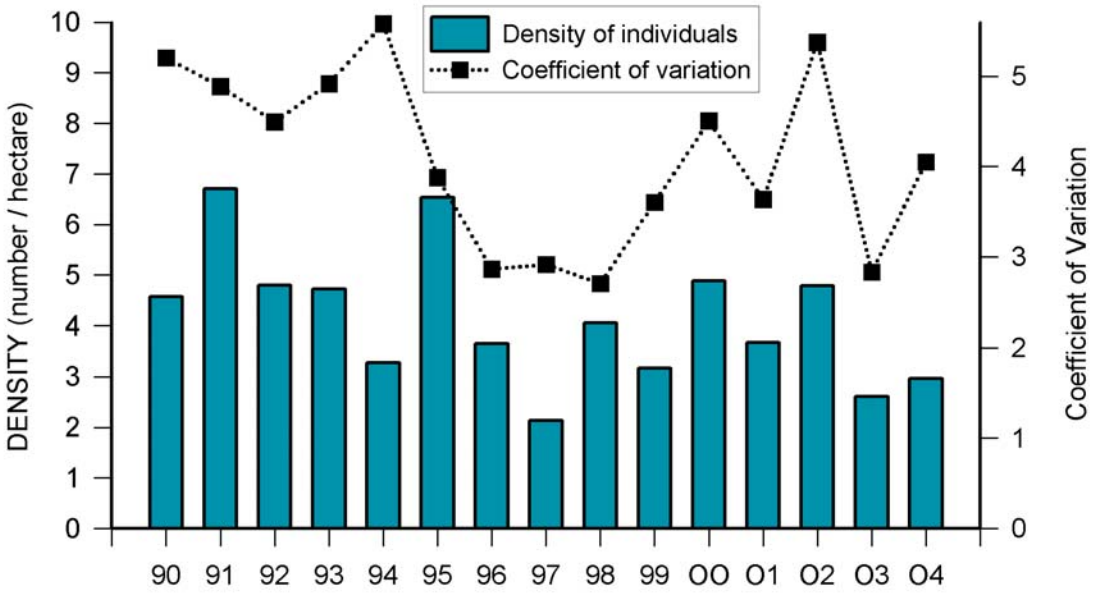

Figure 29. Annual densities of *Peprilus paru*

Table 18 . Estimates of density (number of individuals/hectare) in 2004.

Peprilus paru

	Spring	Summer	Fall	Region
Raleigh Bay	2.4	4.4	20.9	9.4
Onslow Bay	0.2	0.8	8.5	3.1
Long Bay	0.3	5.4	1.9	2.9
South Carolina	1.5	1.5	1.8	1.6
Georgia	0.7	1.4	5.3	2.5
Florida	1.3	1.1	0.9	1.1
Season	1.0	2.1	5.9	3.0

Fork lengths of *Peprilus paru* ranged from 3 to 20 cm ($\bar{x}$ = 11.5). Length was significantly different among seasons (X^2 = 597, p < 0.0001). Mean length decreased from summer to fall, an indication of recruitment of YOY in fall (Figure 30). Mean length also varied significantly among regions (X^2 = 450, p < 0.0001). Mean lengths of harvestfish were greatest in collections from Raleigh Bay (Figure 31).

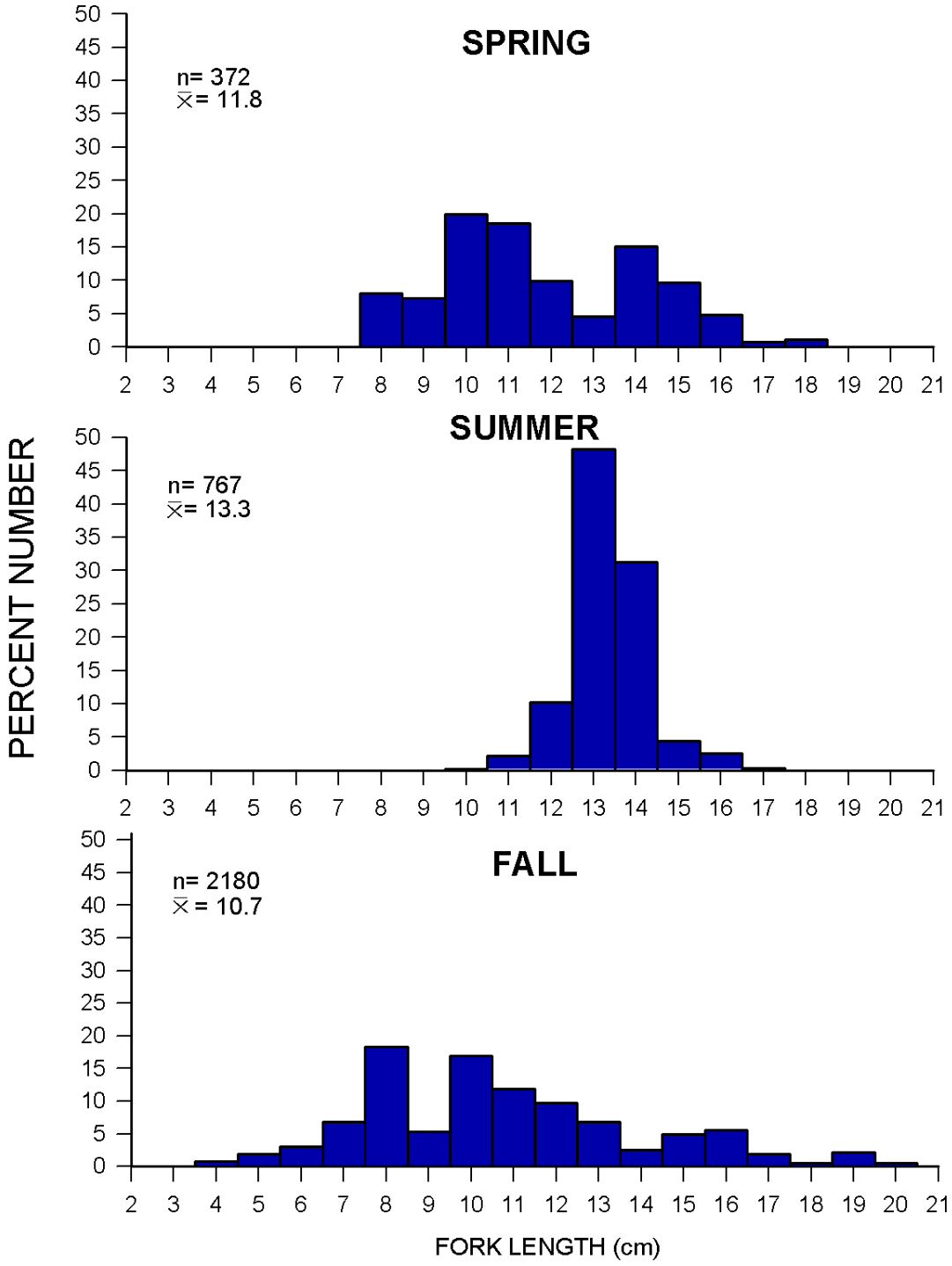

Figure 30. Seasonal length-frequencies of *Peprilus paru* in 2004

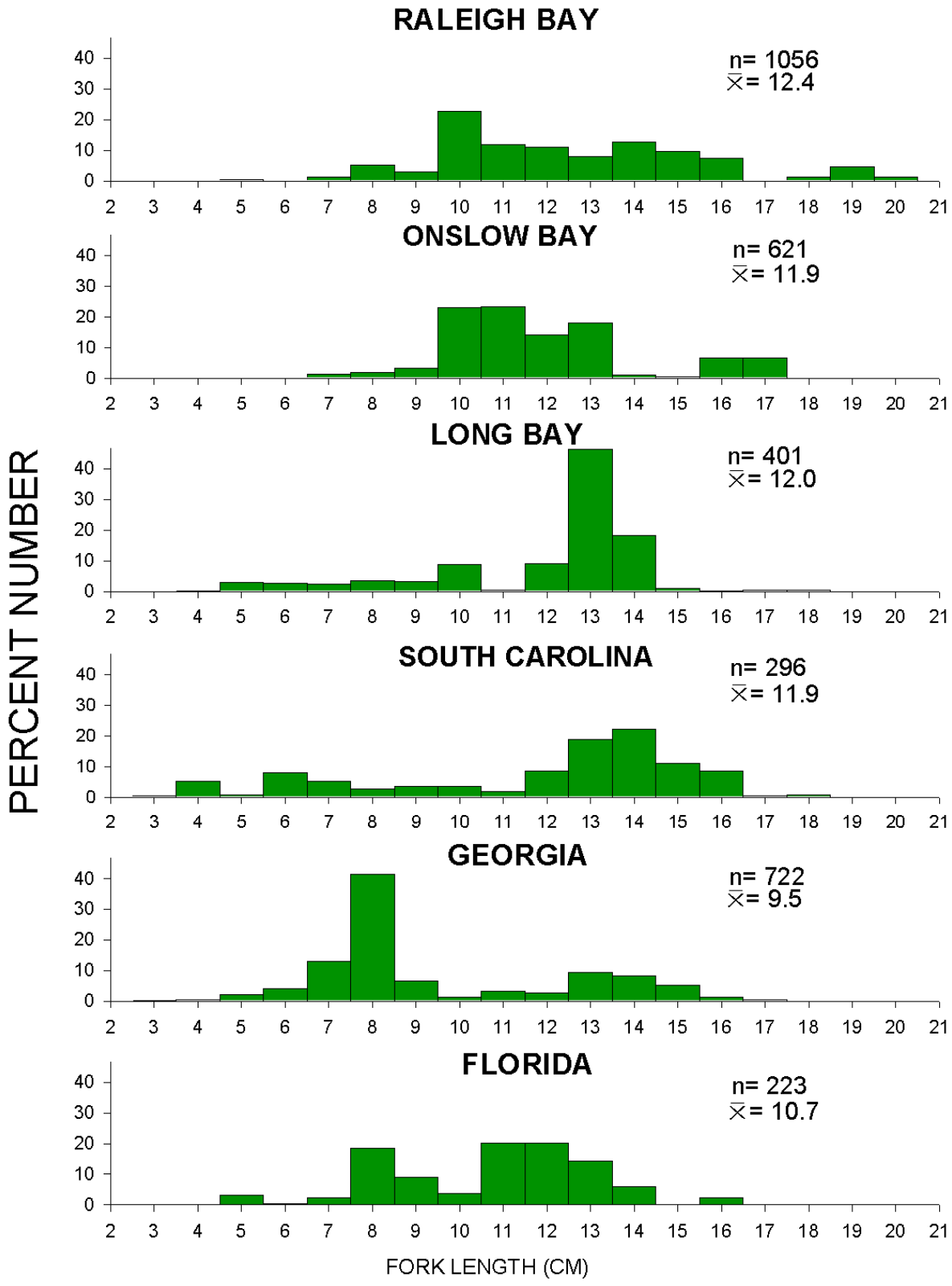

Figure 31. Regional length-frequencies of *Peprilus paru* in 2004

Peprilus triacanthus

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 38,900 *Peprilus triacanthus* (CV=9.1; 34.7 individuals/ha), weighing 1653 kg (1.5 kg/ha), in 2004. Density of individuals was approximately equal to the highest density observed in 2001 (Figure 32). Seasonal density was greatest in spring (Table 19). Raleigh and Long Bays exhibited the highest regional densities. Butterfish are generally most abundant in the northern portion of the SAB, with density decreasing with decreasing latitude (SEAMAP-SA/SCMRD, 2000).

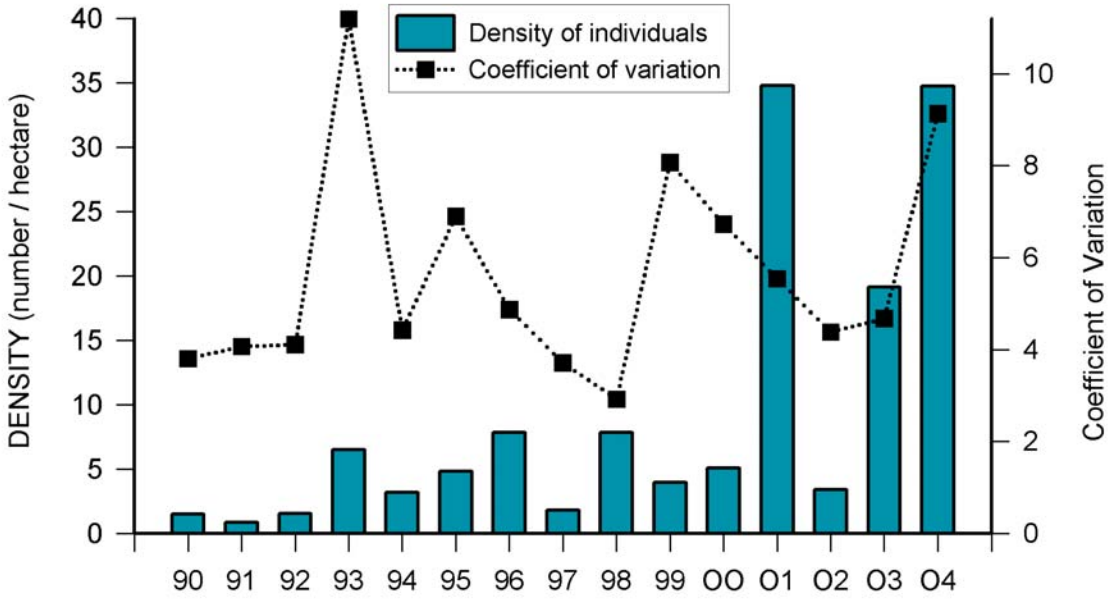

Figure 32. Annual densities of *Peprilus triacanthus*

Table 19 . Estimates of density (number of individuals/hectare) in 2004.

Peprilus triacanthus

	Spring	Summer	Fall	Region
Raleigh Bay	384.0	7.9	16.8	129.0
Onslow Bay	249.1	2.3	0.1	84.0
Long Bay	30.9	4.7	1.2	12.2
South Carolina	8.7	1.3	0.6	3.6
Georgia	13.2	0.5	0.2	4.9
Florida	53.5	4.7	0.02	20.6
Season	97.1	3.0	2.1	34.7

Fork lengths of *Peprilus triacanthus* ranged from 4 to 18 cm ($\bar{x}$ = 12.2). Length was significantly different among seasons ($X^2 = 290$, $p < 0.0001$). Mean length increased from spring to fall (Figure 33). Mean length also varied significantly among regions ($X^2 = 9852$, $p < 0.0001$). Mean lengths of butterfish were greatest in collections from Raleigh and Onslow Bays (Figure 34).

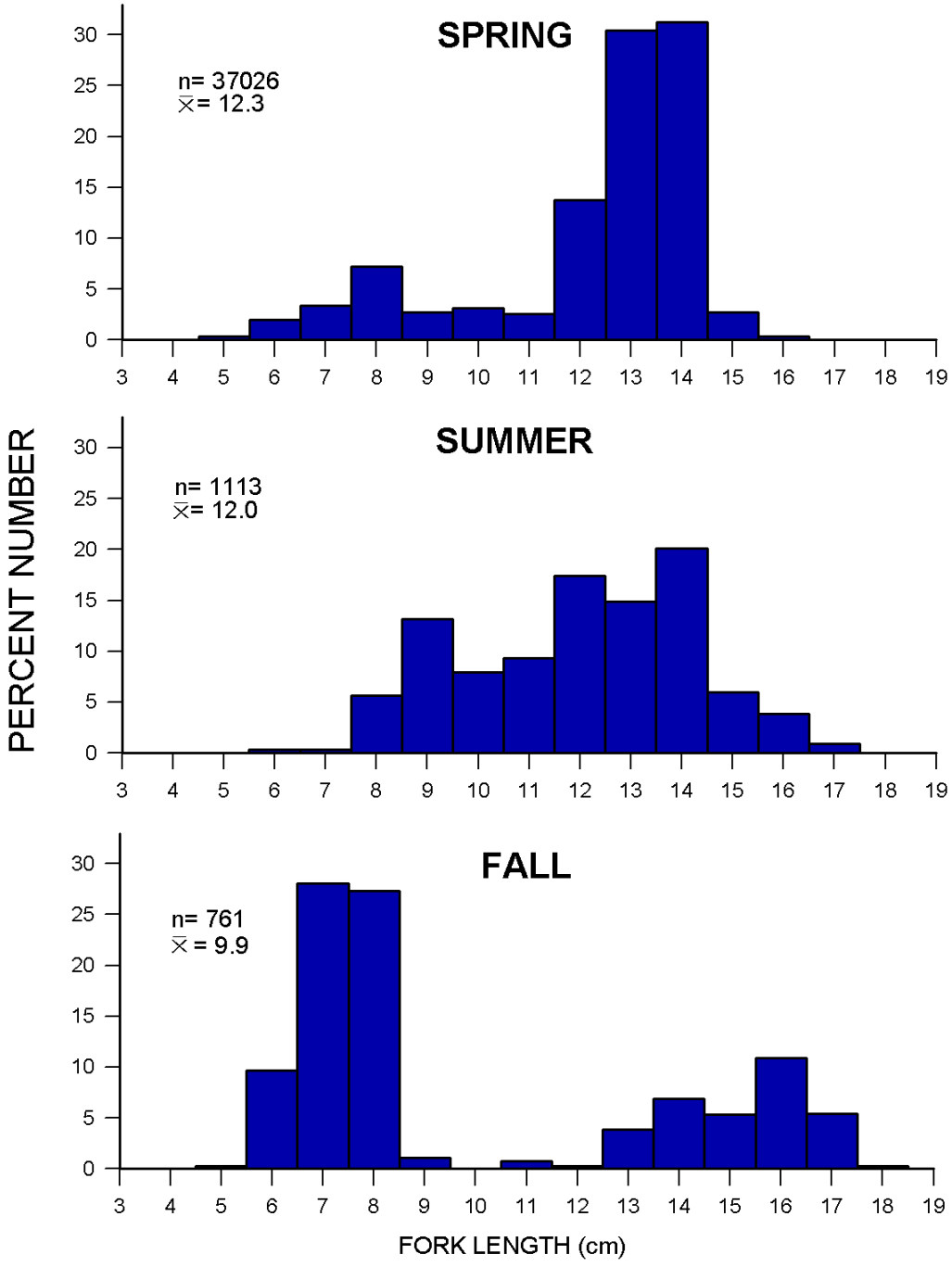

Figure 33. Seasonal length-frequencies of *Peprilus triacanthus* in 2004

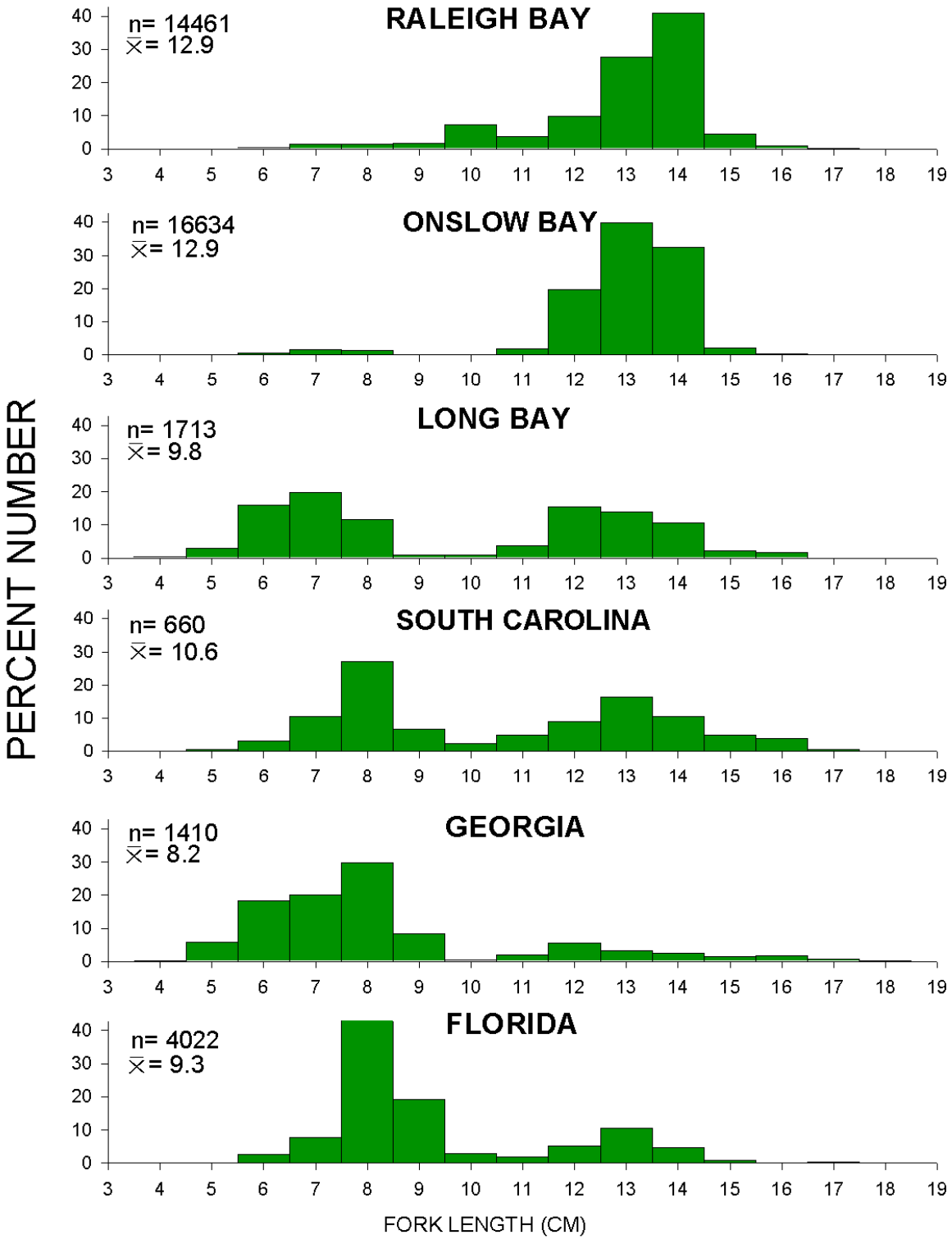

Figure 34. Regional length-frequencies of *Peprilus triacanthus* in 2004

Pogonias cromis

The black drum, *Pogonias cromis*, has been a rare species in SEAMAP-SA Shallow Water Trawl Survey collections (SEAMAP-SA/SCMRD, 2000). One specimen was collected in 2004 (Figure 35).

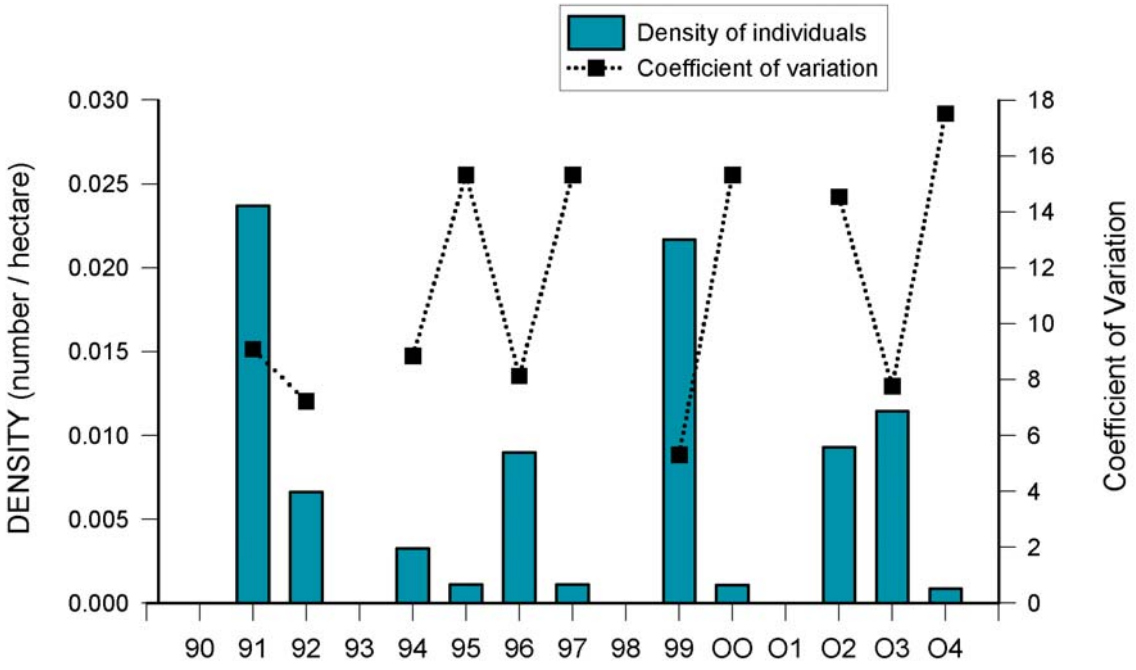

Figure 35. Annual densities of *Pogonias cromis*

Pomatomus saltatrix

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 5,463 bluefish (CV=5.6; 4.9 individuals/ha), weighing 382 kg (0.3 kg/ha). Density in 2004 was the highest observed in the history of the survey (Figure 36). In 2004, density was greatest in spring (Table 20). Bluefish were most abundant in Raleigh Bay.

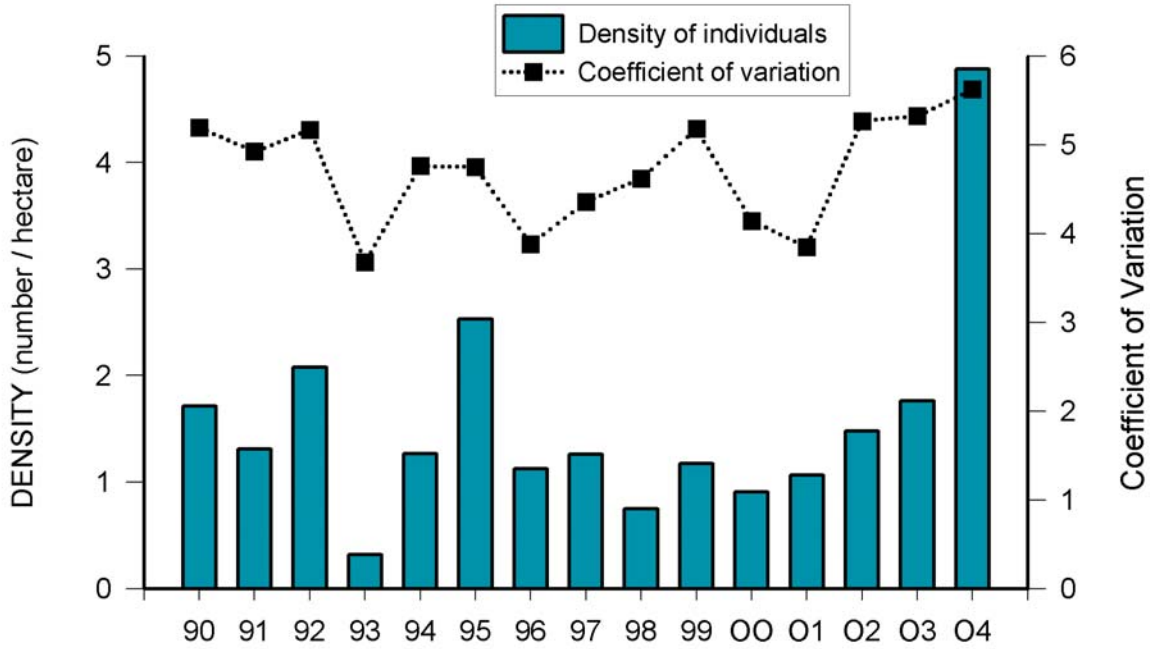

Figure 36. Annual densities of *Pomatomus saltatrix*

Table 20 . Estimates of density (number of individuals/hectare) in 2004.

Pomatomus saltatrix

	Spring	Summer	Fall	Region
Raleigh Bay	70.5	0.6	3.2	23.4
Onslow Bay	23.6	1.5	1.2	8.8
Long Bay	17.2	0.3	0.2	5.9
South Carolina	1.3	0.1	0.2	0.5
Georgia	0.9	0.09	0	0.3
Florida	0.4	0.4	0.3	0.4
Season	13.2	0.5	0.7	4.9

Fork lengths of *Pomatomus saltatrix* ranged from 10 to 33 cm ($\bar{x}$ = 17.3). Length was significantly different among seasons (X^2 =714, $p < 0.0001$). Mean length increased from spring to fall, reflecting juvenile growth (Figure 37). Length also varied significantly among regions (X^2 = 527, $p < 0.0001$), with larger fish occurring in the southern portion of the SAB (Figure 38).

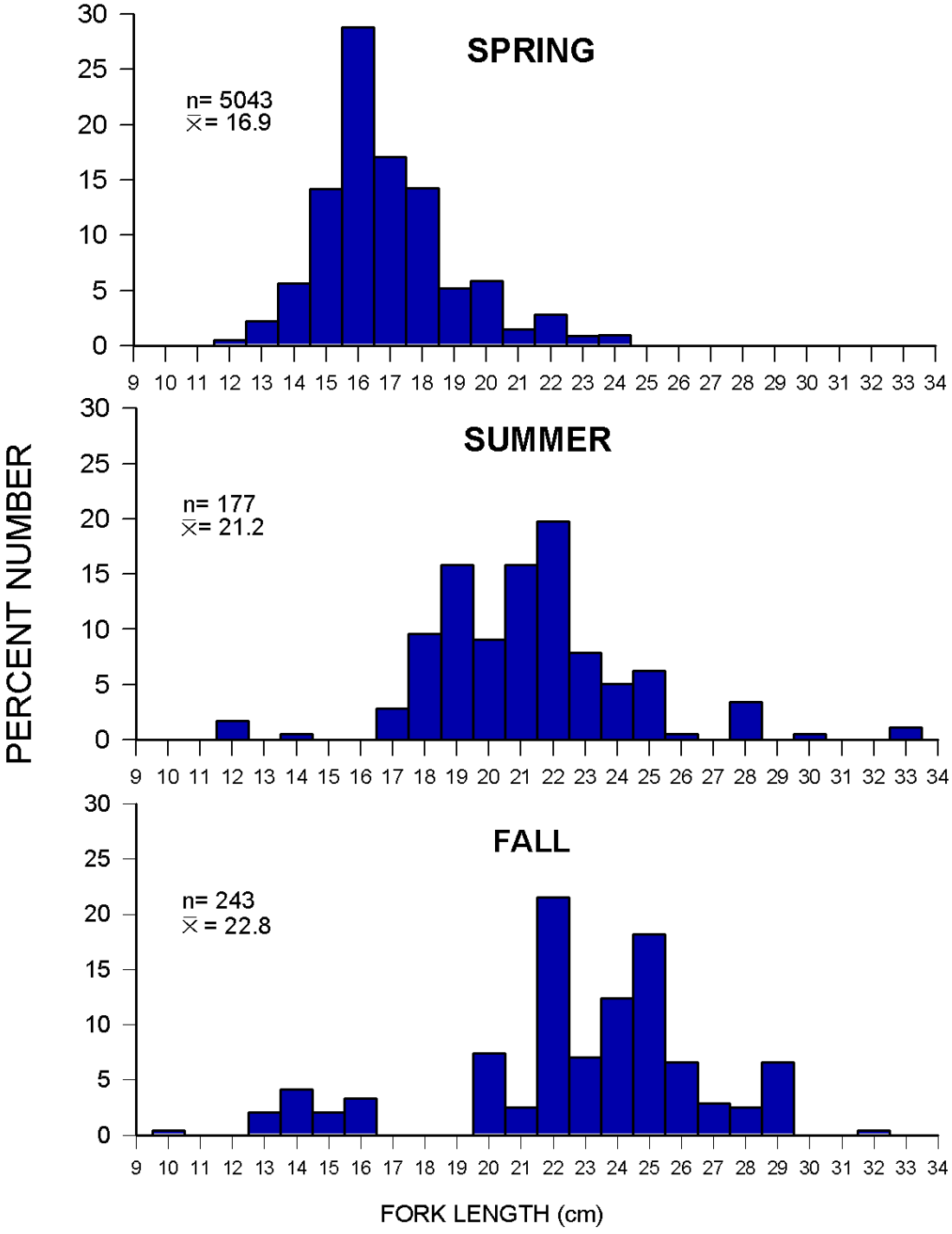

Figure 37. Seasonal length-frequencies of *Pomatomus saltatrix* in 2004

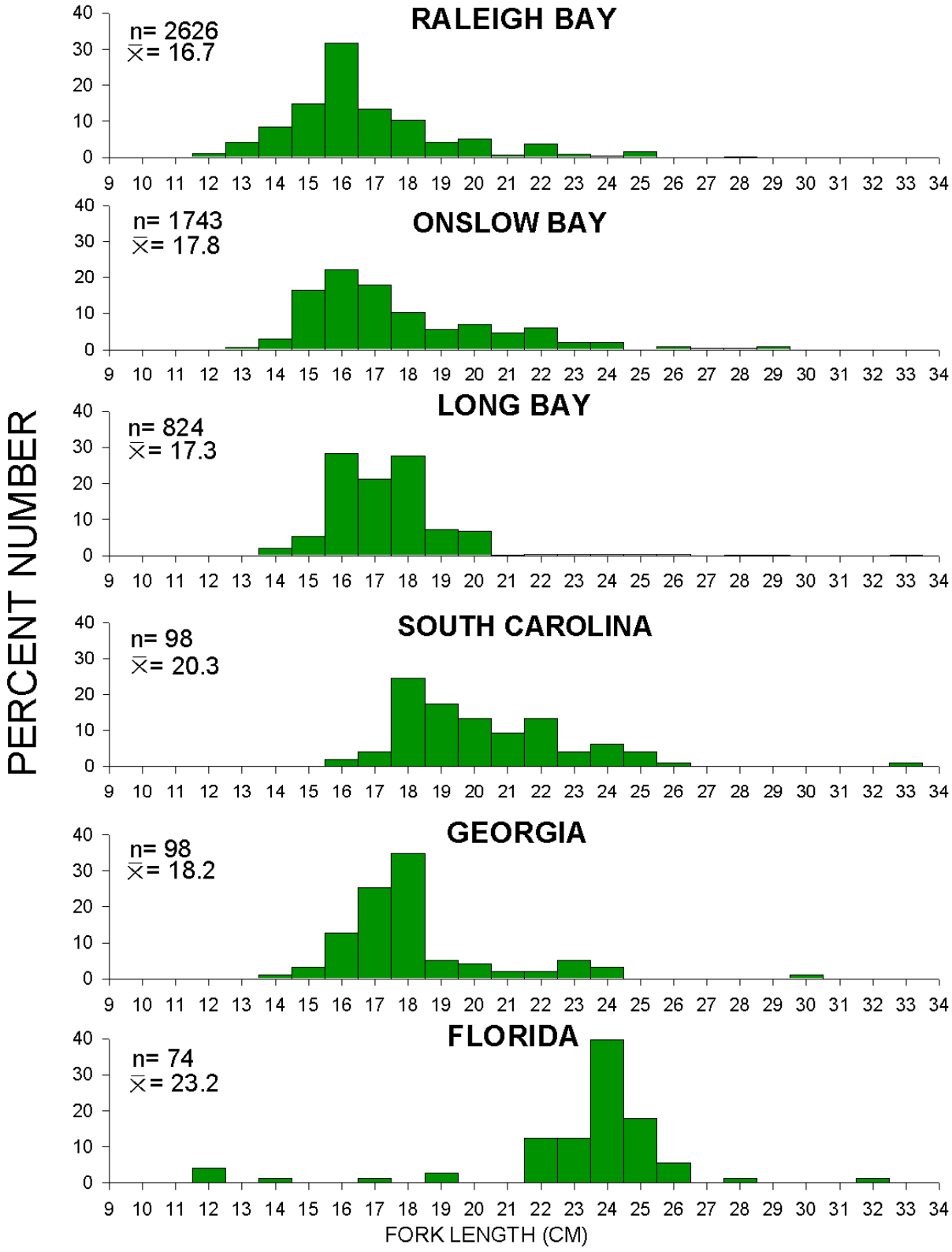

Figure 38. Regional length-frequencies of *Pomatomus saltatrix* in 2004

Sciaenops ocellatus

The red drum has been a very rare species in SEAMAP-SA trawls (SEAMAP-SA/SCMRD, 2000). In the history of the trawl survey only six specimens have been collected (ranging from northern Georgia to southern Long Bay). In 2004, no red drum was taken in SEAMAP collections (Figure 39).

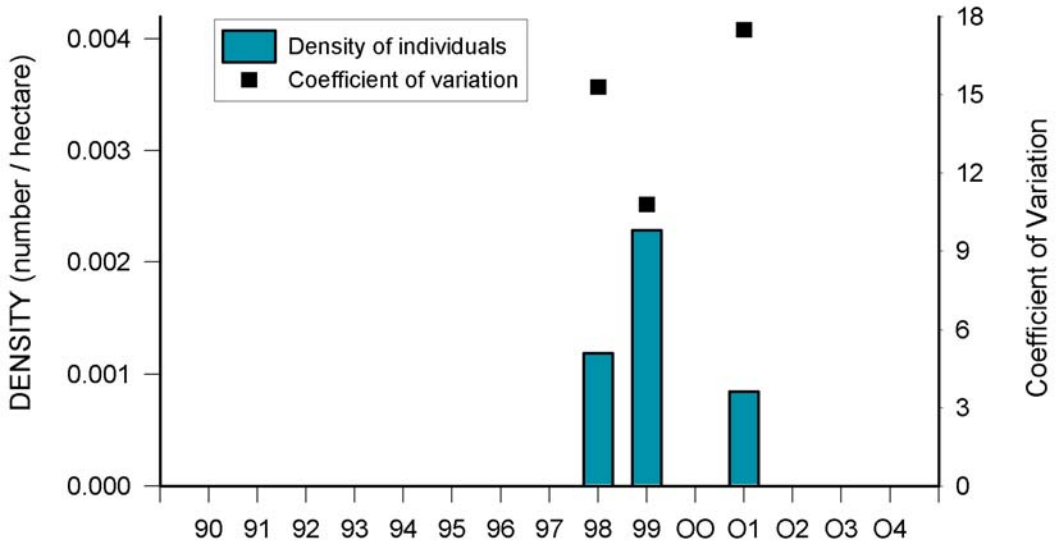

Figure 39. Annual densities of *Sciaenops ocellatus*

Scomberomorus cavalla

The 1,623 (CV=9.1; 1.4 individuals/ha) king mackerel collected from SEAMAP-SA Shallow Water Trawl Survey strata in 2004 weighed 74 kg (0.07 kg/ha). The density of king mackerel in 2004 was slightly lower than the peak observed in 1998 (Figure 40). In 2004, density was greatest in fall (Table 21). Greatest density of king mackerel occurred in Long Bay, although king mackerel tend to be most abundant in fall in the southern SAB (SEAMAP-SA/SCMRD, 2000).

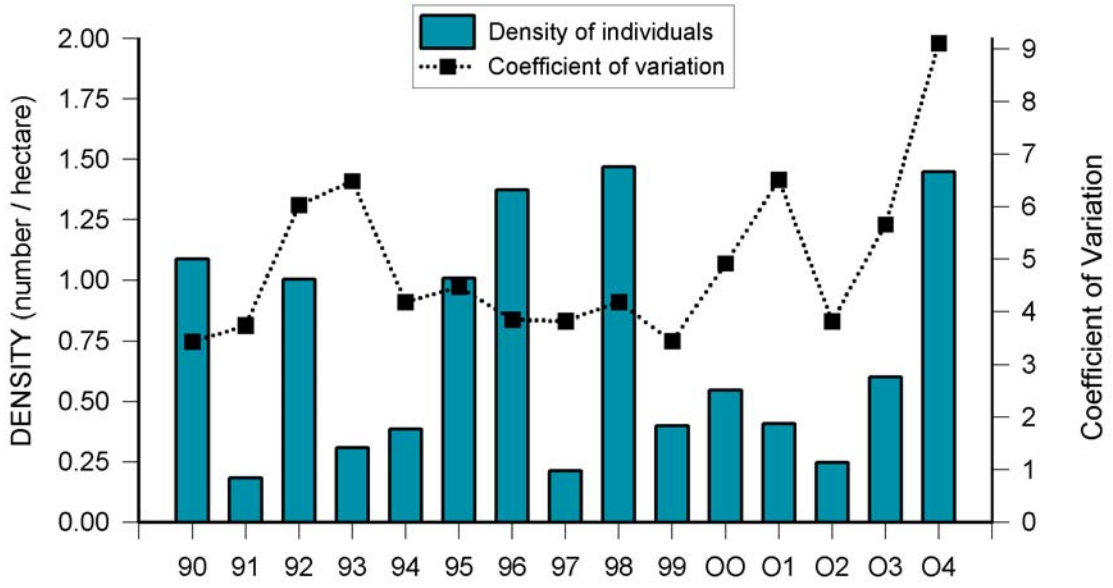

Figure 40. Annual densities of *Scomberomorus cavalla*

Table 21 . Estimates of density (number of individuals/hectare) in 2004.

Scomberomorus cavalla

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0	0	4.7	1.6
Long Bay	0	0.04	17.4	5.9
South Carolina	0.02	0.05	3.1	1.0
Georgia	0.2	0.09	0.2	0.2
Florida	1.4	0.2	2.3	1.3
Season	0.3	0.07	4.0	1.4

Fork lengths of *Scomberomorus cavalla* ranged from 5 to 36 cm ($\bar{x}$ = 15.5) and represented two year-classes. Annual cohorts of king mackerel are spawned in spring and summer (Finucane et al., 1986) and reach mean lengths greater than 40 cm by the end of their first year (Collins et al., 1989). Lengths were significantly different among seasons ($X^2 = 334$, $p < 0.0001$) and mean length deceased from spring to fall, as the result of recruitment of YOY (Figure 41). The fish less than 15 cm and greater than 34 cm in summer suggest that recruitment was beginning and that a few specimens older year classes still present. Lengths varied significantly among regions ($X^2 = 1023$, $p < 0.0001$), with greatest mean length in the southern portion of the SAB and mean size decreasing from north to south (Figure 42).

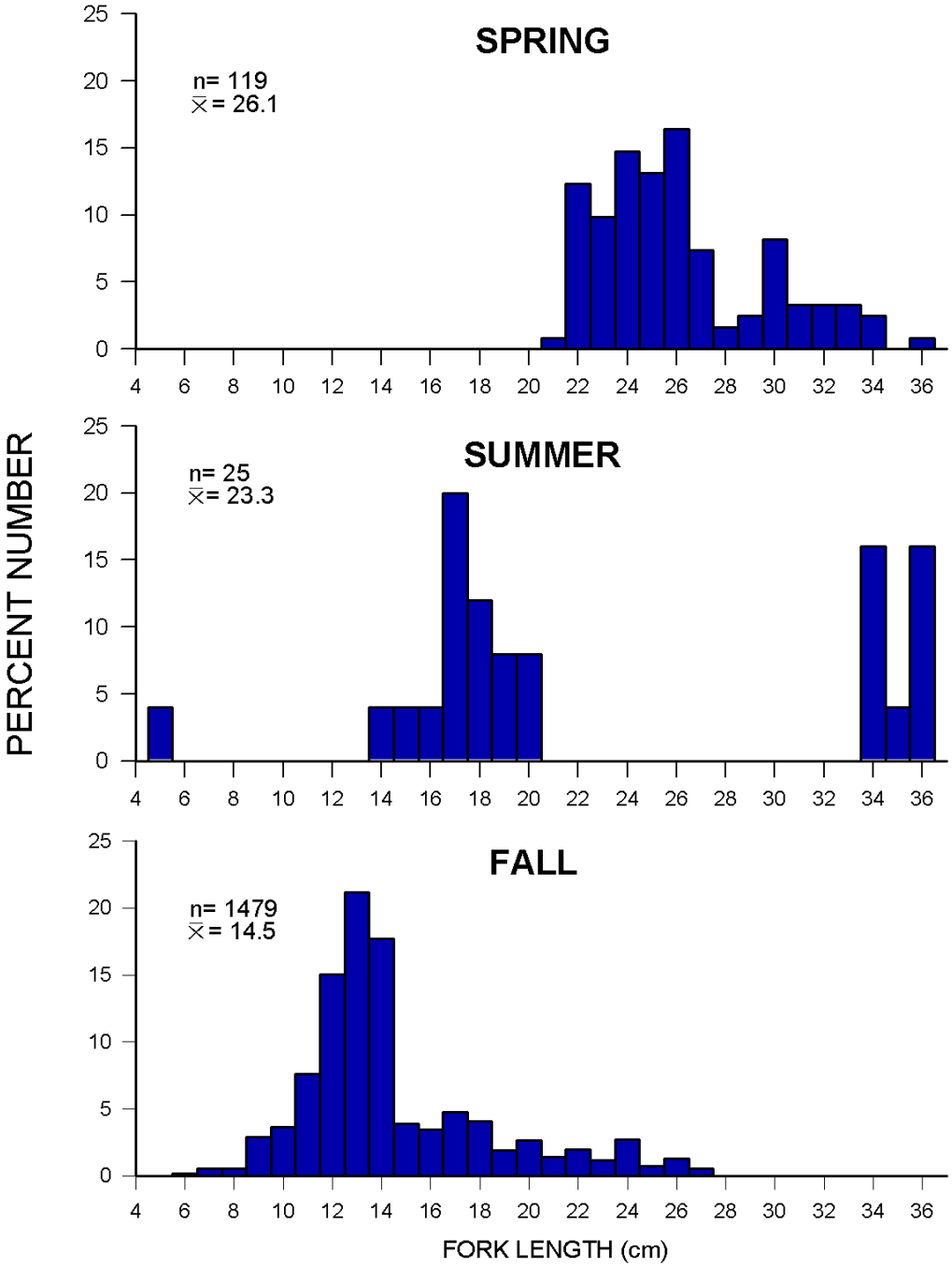

Figure 41. Seasonal length-frequencies of *Scomberomorus cavalla* in 2004

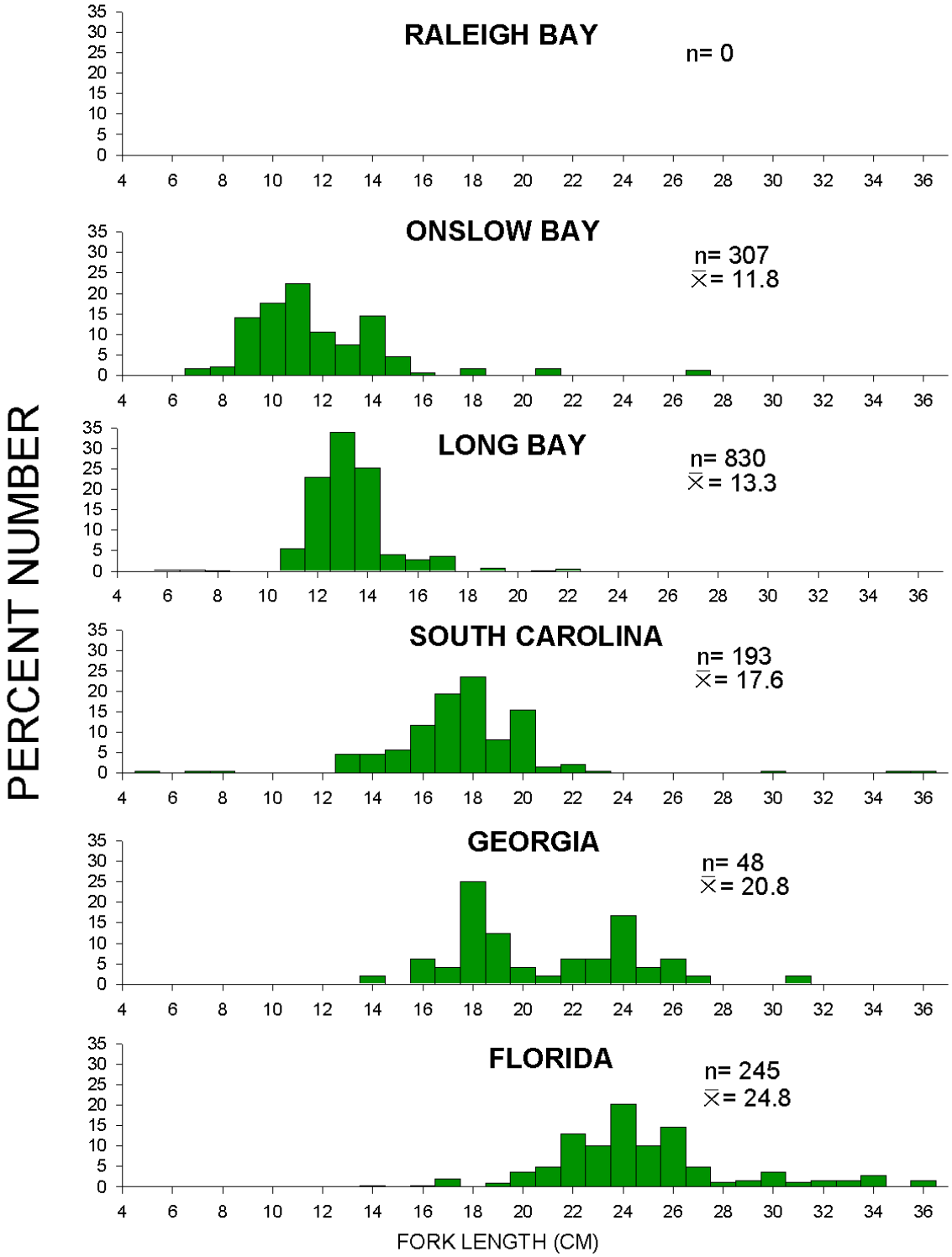

Figure 42. Regional length-frequencies of *Scomberomorus cavalla* in 2004

Scomberomorus maculatus

Sampling in 2004 produced 1,100 Spanish mackerel that weighed a total of 134 kg (CV=2.8; 1.0 individuals/ha; 0.1 kg/ha). The density of individuals of Spanish mackerel in 2004 increased slightly from the level observed in 2003 (Figure 43). Highest density of Spanish mackerel is generally found in the southern SAB (SEAMAP-SA/SCMRD, 2000); however, in 2004 Spanish mackerel were taken throughout the SAB in fall (Table 22).

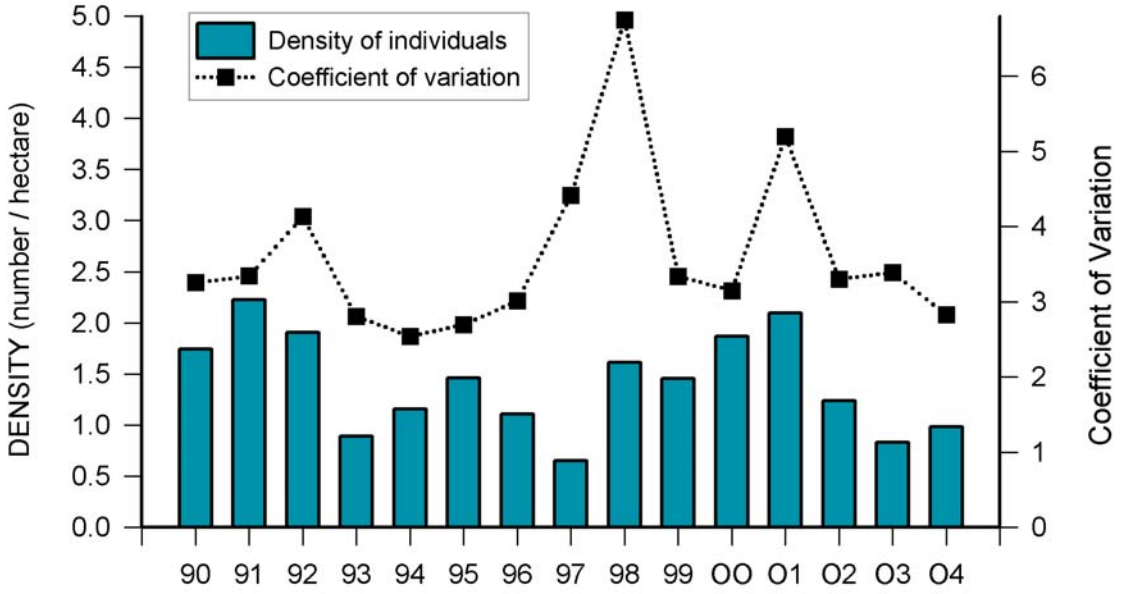

Figure 43. Annual densities of *Scomberomorus maculatus*

Table 22. Estimates of density (number of individuals/hectare) in 2004.

Scomberomorus maculatus

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	1.0	0.3
Onslow Bay	0.1	0.9	0.7	0.6
Long Bay	0	0.3	0.7	0.4
South Carolina	0.1	2.1	1.5	1.2
Georgia	0.8	0.2	1.9	1.0
Florida	4.5	0.2	1.1	2.0
Season	1.1	0.6	1.3	1.0

Fork lengths of Spanish mackerel ranged from 10 to 54 cm ($\bar{x}$ = 22.5 cm). Lengths differed significantly among seasons (X^2 = 552, $p < 0.0001$). Mean length decreased from spring to summer, indicating the recruitment of YOY individuals, and increased in fall as the result of subsequent juvenile growth (Figure 44). By the end of their first year, Spanish mackerel reach lengths greater than 30 cm (Powell, 1975). Specimens collected in spring were generally fish ending their first year. Summer collections contained primarily newly recruited YOY with a few representatives of the previous year-class still present. Fall collections were made up of fish from two year-classes. Length also varied significantly among regions (X^2 = 430, $p < 0.0001$), and mean lengths ranged from a low of 17.3 cm in Long Bay to 26.2 cm off Florida (Figure 45).

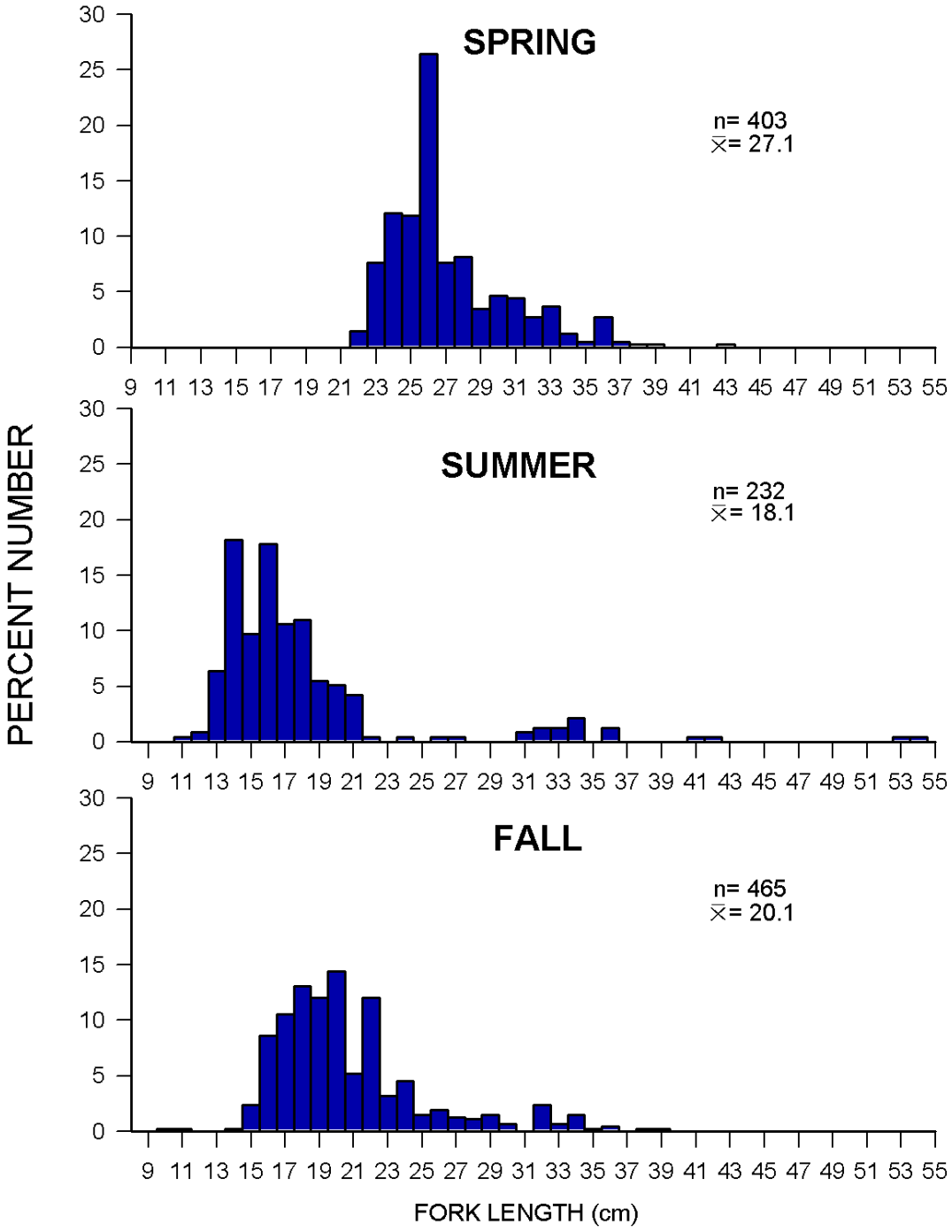

Figure 44. Seasonal length-frequencies of *Scomberomorus maculatus* in 2004

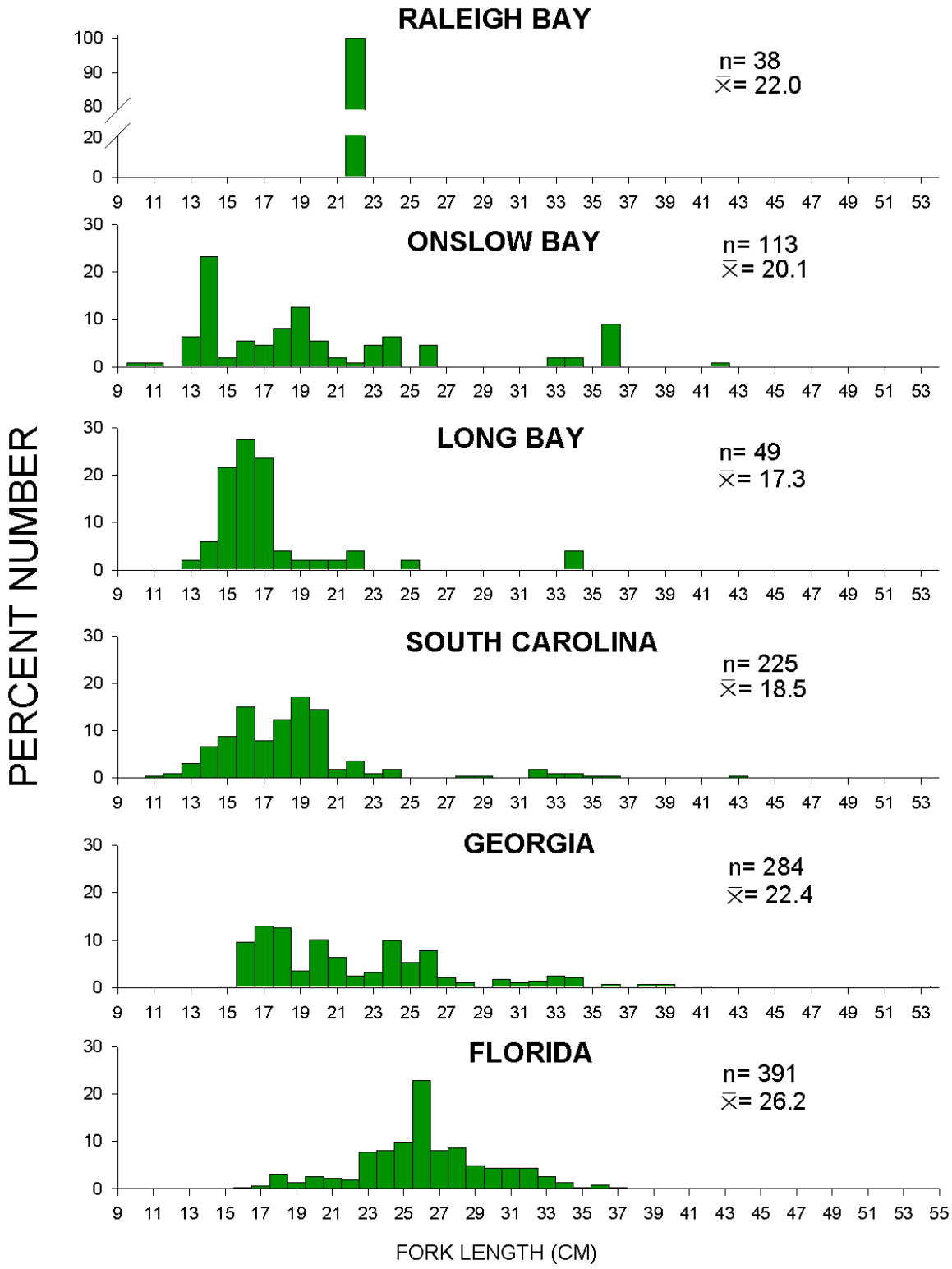

Figure 45. Regional length-frequencies of *Scomberomorus maculatus* in 2004

Callinectes sapidus

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 995 (CV=4.9; 0.9 individuals/ha) blue crabs, weighing 126 kg (0.1 kg/ha). Overall density of *C. sapidus* peaked in 1990, followed by several years of low abundance and secondary peaks in 1999 and 2004 (Figure 46). In 2004, the highest seasonal density was observed during summer cruises and the greatest regional density of individuals occurred in Raleigh Bay (Table 23). Carapace widths of *C. sapidus* ranged from 5 to 20 cm ($\bar{x}$ = 13.3).

Males constituted only 3% of the blue crab catch. The tendency of males to inhabit lower salinity estuarine waters explains their lesser importance in offshore catches (Low et al., 1987). Mature female blue crab dominated catches, with approximately 32% of females being ovigerous. Non-ovigerous females outnumbered ovigerous females in all seasons.

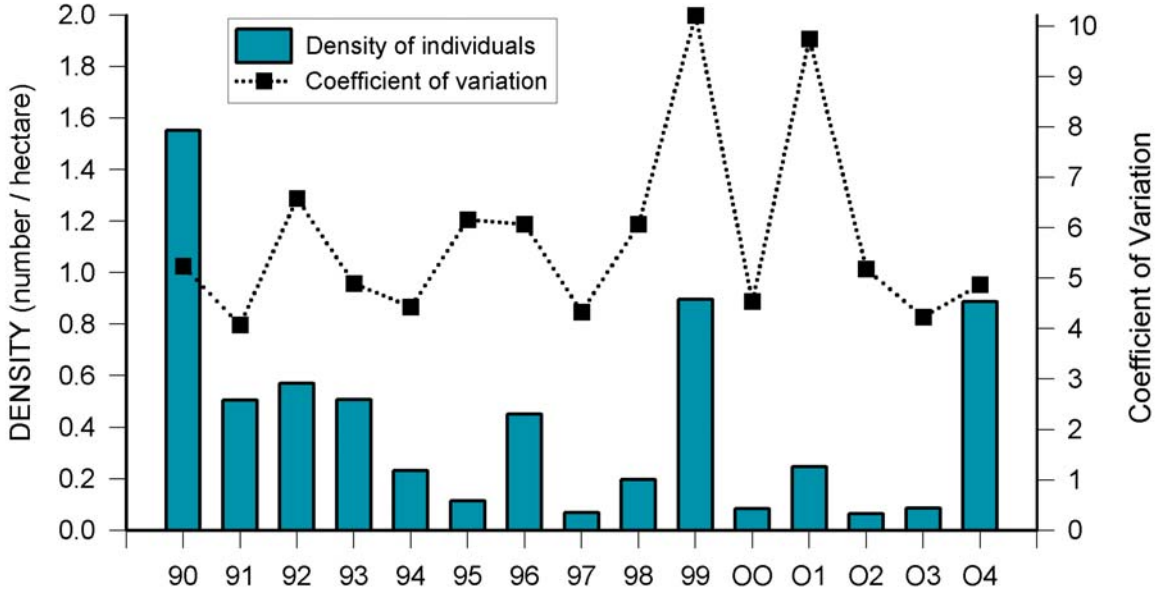

Figure 46. Annual densities of *Callinectes sapidus*

Table 23 . Estimates of density (number of individuals/hectare) in 2004.

Callinectes sapidus

	Spring	Summer	Fall	Region
Raleigh Bay	0	13.1	1.3	5.0
Onslow Bay	0.3	1.5	0.5	0.8
Long Bay	0	0.04	0	0.01
South Carolina	0	0.05	0	0.2
Georgia	0.01	1.0	0	0.3
Florida	0.07	2.3	0.03	0.8
Season	0.07	2.4	0.2	0.9

Farfantepenaeus aztecus

The brown shrimp, formerly *Penaeus aztecus* (Perez-Farfante and Kensley, 1997), was the second most abundant decapod crustacean species taken in 2004 by the SEAMAP-SA Trawl Survey, with 9,828 individuals (CV=4.1; 8.8 individuals/ha), weighing 170 kg (0.2 kg/ha). The estimate of density of brown shrimp in 2004 represents the third highest abundance in the history of the survey (Figure 47). Summer collections produced the highest seasonal density (Table 24). The overall seasonal pattern of abundance of brown shrimp includes small spring catches, followed by larger summer catches, and moderately-sized fall catches (SEAMAP-SA/SCMRD, 2000). The greatest regional density of brown shrimp occurred in Raleigh Bay.

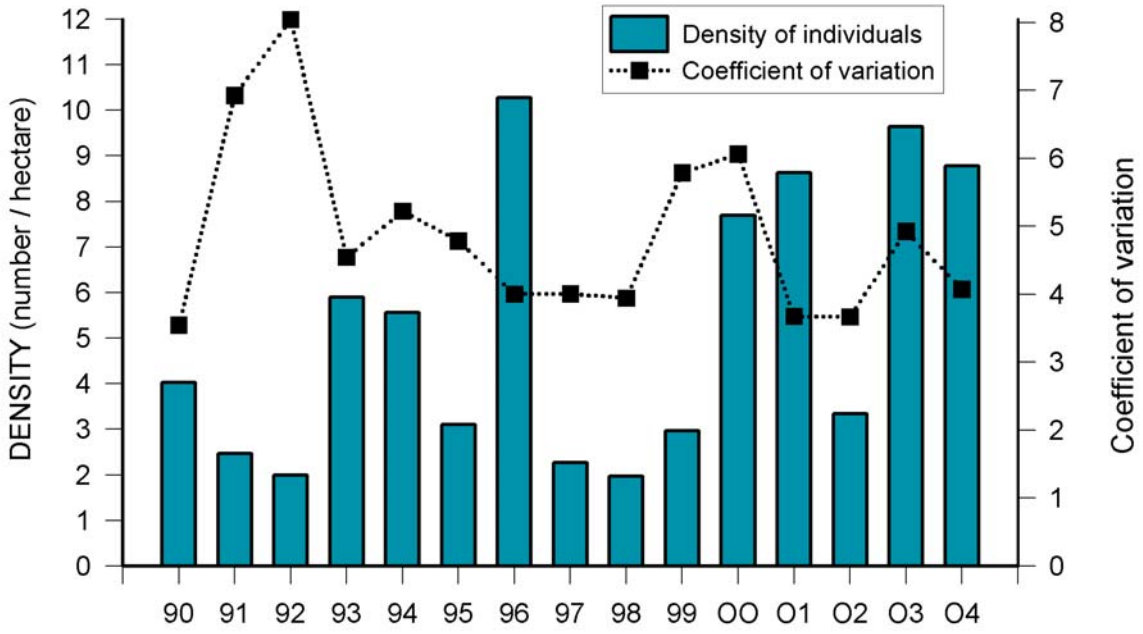

Figure 47. Annual densities of *Farfantepenaeus aztecus*

Table 24 . Estimates of density (number of individuals/hectare) in 2004.

Farfantepenaeus aztecus

	Spring	Summer	Fall	Region
Raleigh Bay	0	87.4	9.6	33.4
Onslow Bay	0	34.5	10.6	15.1
Long Bay	0.3	3.1	4.4	2.6
South Carolina	0.02	6.4	1.2	2.5
Georgia	0.1	8.0	0.5	2.7
Florida	5.4	17.0	0	7.6
Season	1.1	21.9	3.7	8.8

Total lengths of *F. aztecus* ranged from 8 to 18 cm with a mean length of 12.1 cm. Total lengths differed significantly among seasons (X^2 =894, $p < 0.0001$). Mean length was lowest in summer and greatest in fall (Figure 48). Lengths were also significantly different among regions (X^2 =1638, $p < 0.0001$). Mean lengths ranged from 11.2 cm in Onslow Bay to 13.0 cm in Georgia (Figure 49).

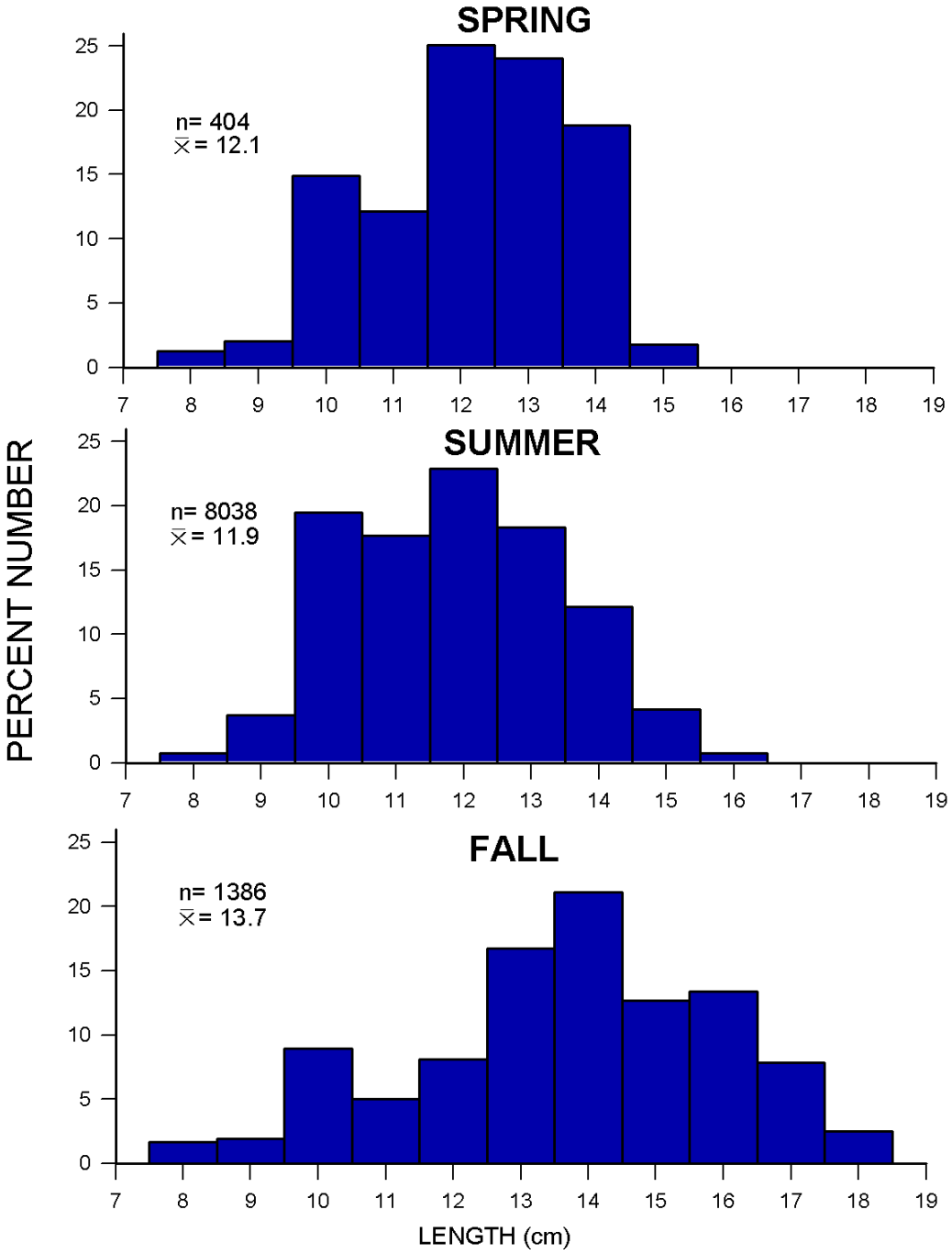

Figure 48. Seasonal length-frequencies of *Farfantepenaeus aztecus* in 2004

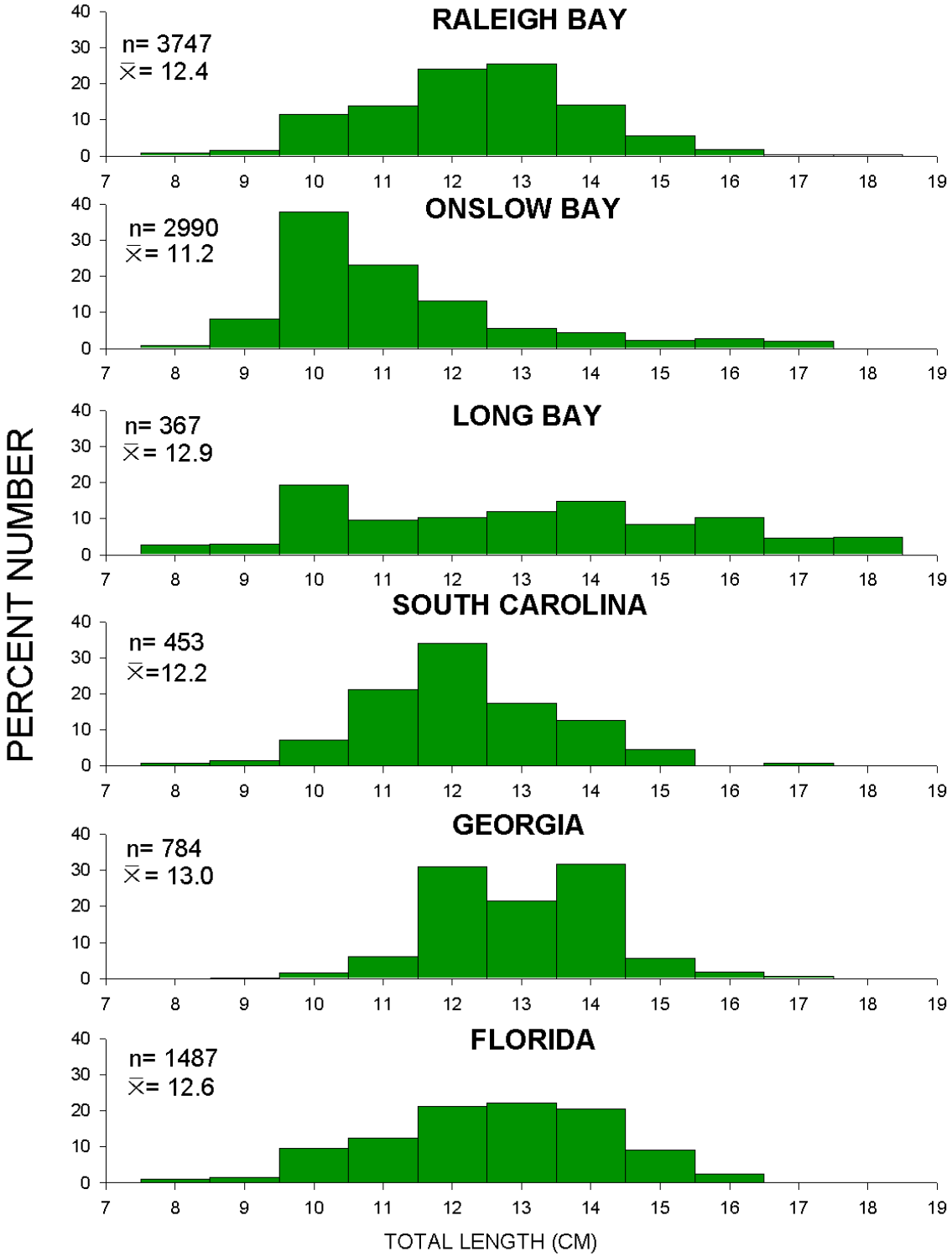

Figure 49. Regional length-frequencies of *Farfantepenaeus aztecus* in 2004

Approximately 54% of the brown shrimp sampled were female. No female brown shrimp with ripe ovaries was sampled in 2004 and less than 1% (only 3 individuals) of the female brown shrimp were found to be mated. Only 3% of the male brown shrimp had fully developed spermatophores (ripe). Spermatophore development was not independent of season ($G = 277$, $p < 0.0001$) or region ($G = 69$, $p < 0.0001$). The majority of males with fully developed spermatophores were taken in fall (Figure 50).

Occurrence of black gill disease in brown shrimp was observed and recorded. Presence of black gill disease was found in less than 1% of the brown shrimp and only in fall 2004. Infestation of brown shrimp occurred in Long Bay and in waters off South Carolina and Georgia.

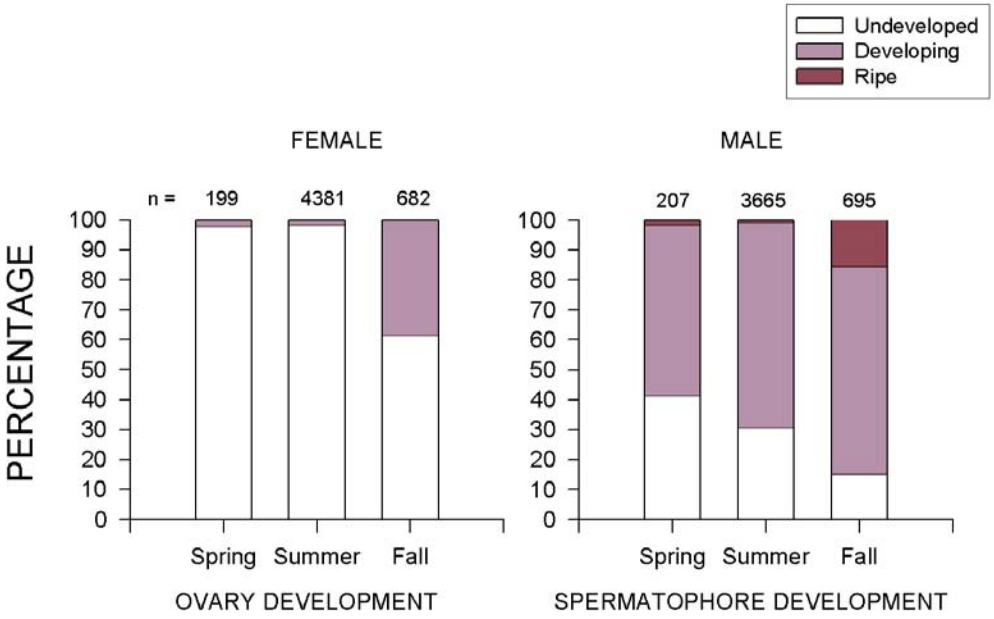

Figure 50. Gonadal development of *Farfantepenaeus aztecus* in 2004

Farfantepenaeus duorarum

The pink shrimp, formerly *Penaeus duorarum* (Perez-Farfante and Kensley, 1997), was the least abundant commercially important penaeid shrimp species collected in 2004. The 429 specimens (CV=5.4; 0.4 individuals/ha) taken from SEAMAP trawls weighed 8 kg (0.007 kg/ha). Density of individuals in 2004 was lower than the 2003 estimate (Figure 51). In 2004, abundance was greatest in spring collections in Onslow Bay. No pink shrimp were taken south of Raleigh Bay in summer or south of Long Bay in fall (Table 25).

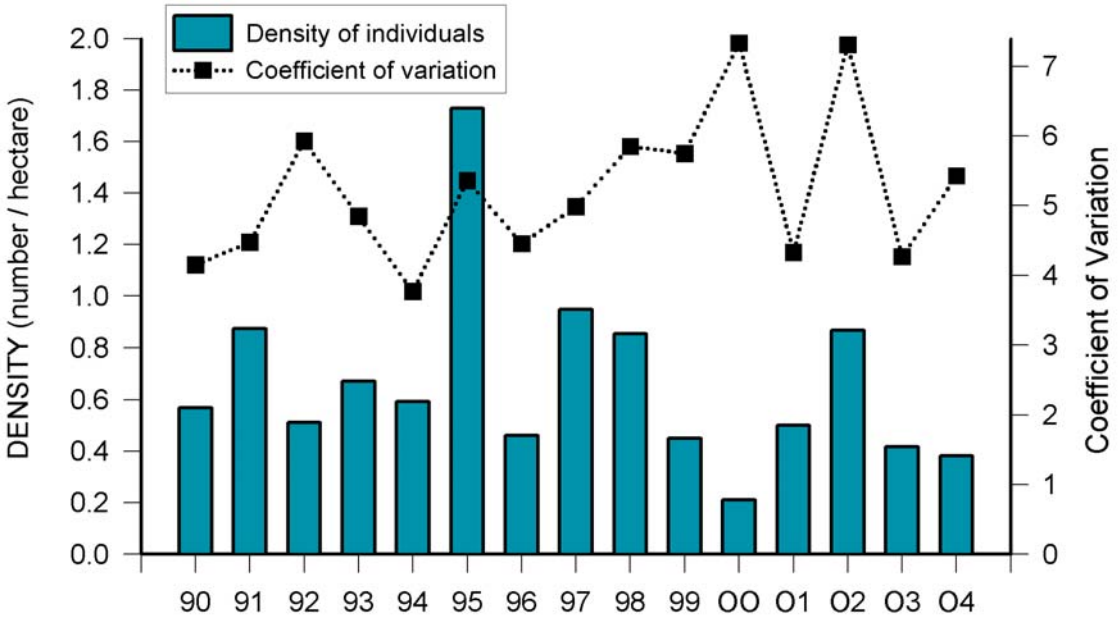

Figure 51. Annual densities of *Farfantepenaeus duorarum*

Table 25 . Estimates of density (number of individuals/hectare) in 2004.

Farfantepenaeus duorarum

	Spring	Summer	Fall	Region
Raleigh Bay	0.03	1.0	1.2	0.8
Onslow Bay	3.4	0	0.3	1.2
Long Bay	0.9	0	0.02	0.3
South Carolina	0.3	0	0	0.09
Georgia	0.2	0	0	0.06
Florida	0.3	0	0	0.1
Season	0.9	0.1	0.2	0.4

Total length of pink shrimp ranged from 8 to 18 cm ($\bar{x}$ =12.3 cm). Total lengths varied significantly among seasons (X^2=88, $p < 0.0001$). Mean length was greatest in spring and smallest in summer (Figure 52). Total length differed significantly among regions (X^2 =117, $p < 0.001$). Regionally, mean lengths ranged from 10.4 cm in Raleigh Bay to 13.8 cm in Long Bay (Figure 53).

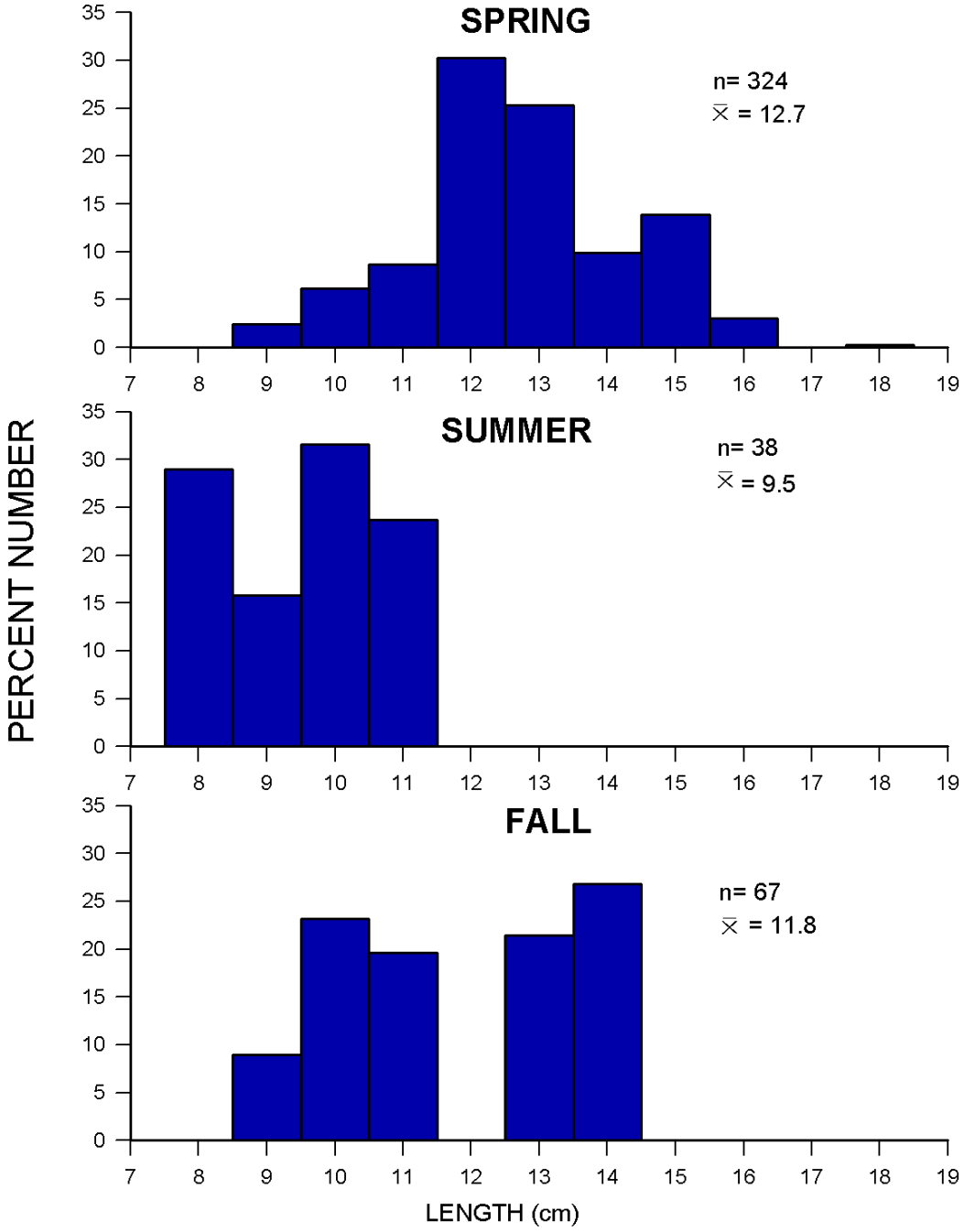

Figure 52. Seasonal length-frequencies of *Farfantepenaeus duorarum* in 2004

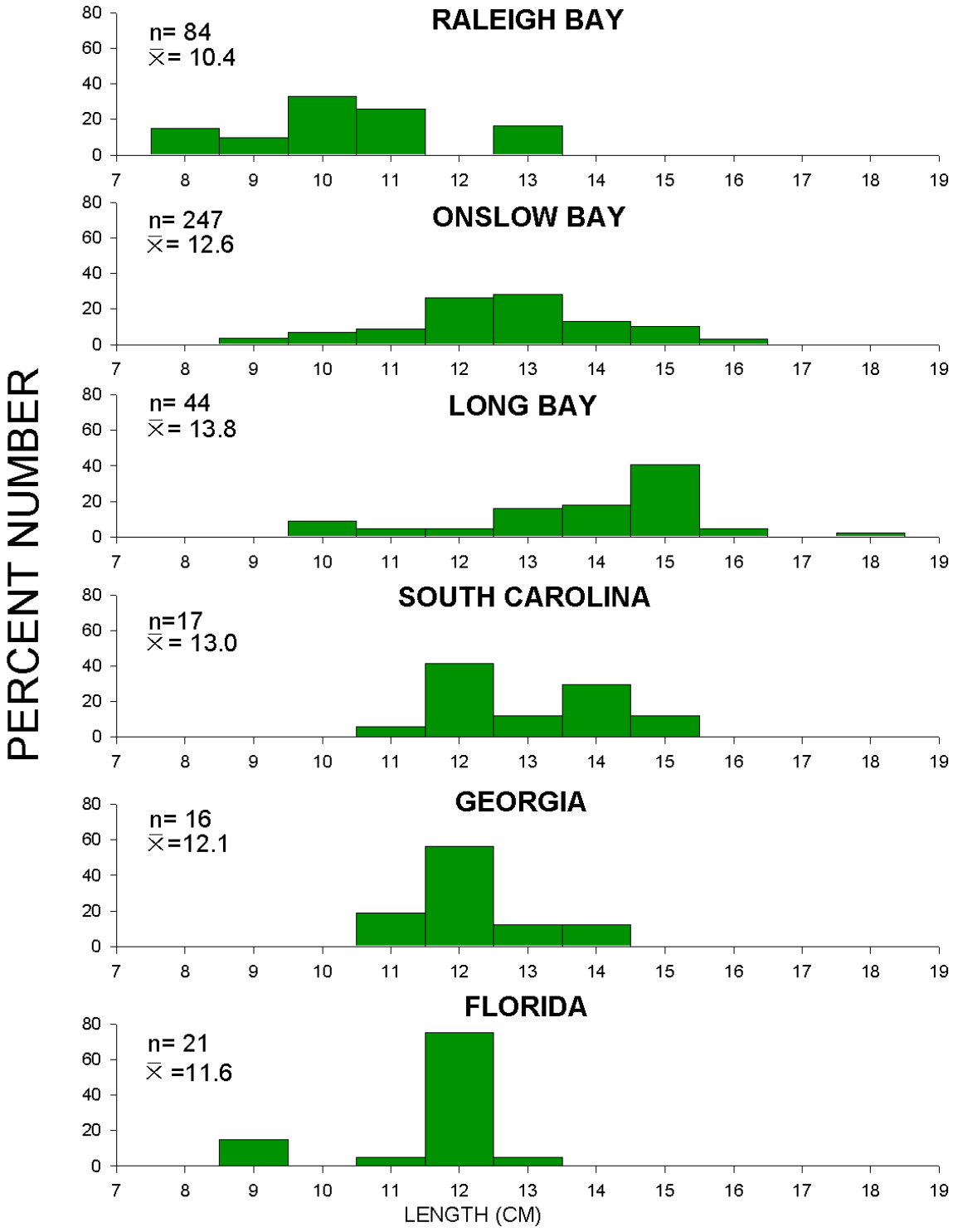

Figure 53. Regional length-frequencies of *Farfantepenaeus duorarum* in 2004

In SEAMAP-SA Shallow Water Trawl Survey strata approximately 53% of all pink shrimp were found to be female. No ripe female pink shrimp were collected in 2004 (Figure 54); however, approximately 3% of the total number of female pink shrimp sampled were mated. Like brown shrimp, copulation in pink shrimp may occur regardless of developmental stage of the ovaries (Perez-Farfante, 1969). More than 8% of male pink shrimp sampled had fully developed spermatophores. Spermatophore development was not independent of season ($G = 24$, $p < 0.0001$) or region ($G = 38$ $p < 0.0001$). Presence of black gill disease was not noted in any pink shrimp.

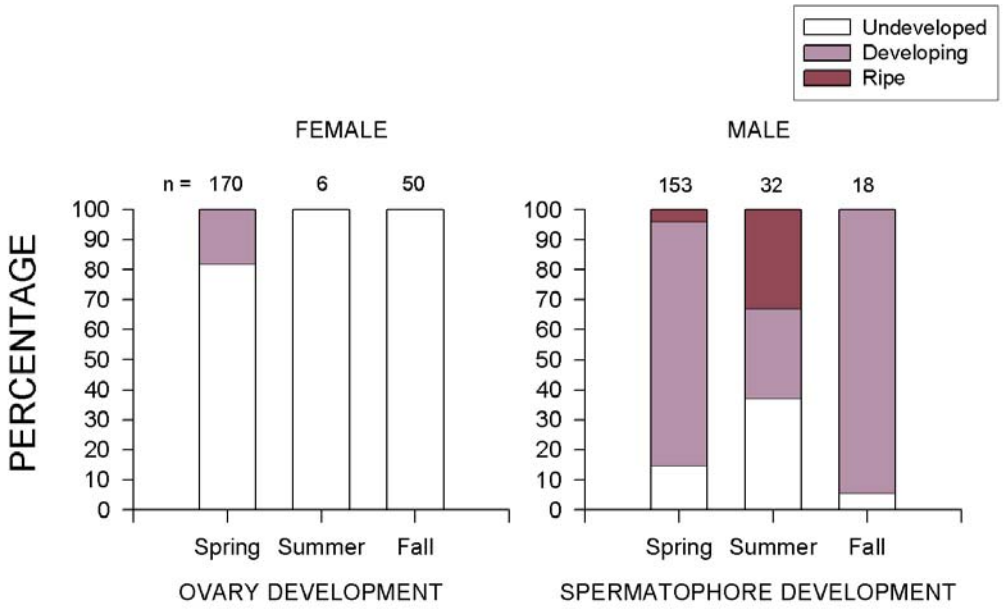

Figure 54. Gonadal development of *Farfantepenaeus duorarum* in 2004

Litopenaeus setiferus

The white shrimp, formerly *Penaeus setiferus* (Perez-Farfante and Kensley, 1997), ranked first among decapod crustaceans, with 28,884 specimens (CV=3.4; 25.8 individuals/ha) collected, weighing 860 kg (0.8 kg/ha). The 2004 estimate of density represents the second highest abundance in the history of the survey (Figure 55). Greatest regional densities of abundance were found in Long Bay and off Florida, due to high fall catches of white shrimp (Table 26).

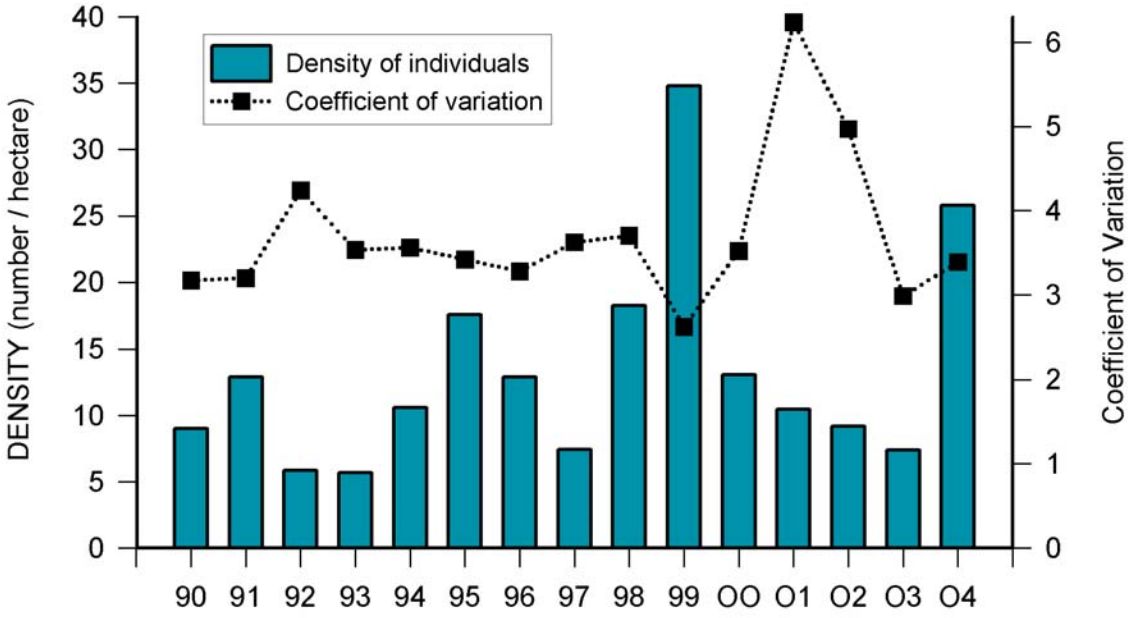

Figure 55. Annual densities of *Litopenaeus setiferus*

Table 26 . Estimates of density (number of individuals/hectare) in 2004.

Litopenaeus setiferus

	Spring	Summer	Fall	Region
Raleigh Bay	0.06	0.3	11.0	3.9
Onslow Bay	0.5	0.3	56.1	18.8
Long Bay	0.3	0.2	122.7	42.0
South Carolina	5.3	3.0	38.4	15.6
Georgia	22.1	2.0	46.3	23.9
Florida	9.5	18.8	118.6	46.3
Season	8.6	4.4	64.6	25.8

Total lengths of *L. setiferus* ranged from 7 to 20 cm, with a mean length of 15.0 cm. There was a significant difference in mean length among seasons (X^2 =1527, $p < 0.0001$) (Figure 56), with mean length greatest in spring and fall. Smaller YOY individuals began moving out of the estuaries in summer. Regional mean lengths also differed significantly (X^2 = 6124, $p < 0.0001$). Onslow Bay produced the smallest mean length (13.8 cm) and Raleigh Bay the greatest (15.9 cm) (Figure 57).

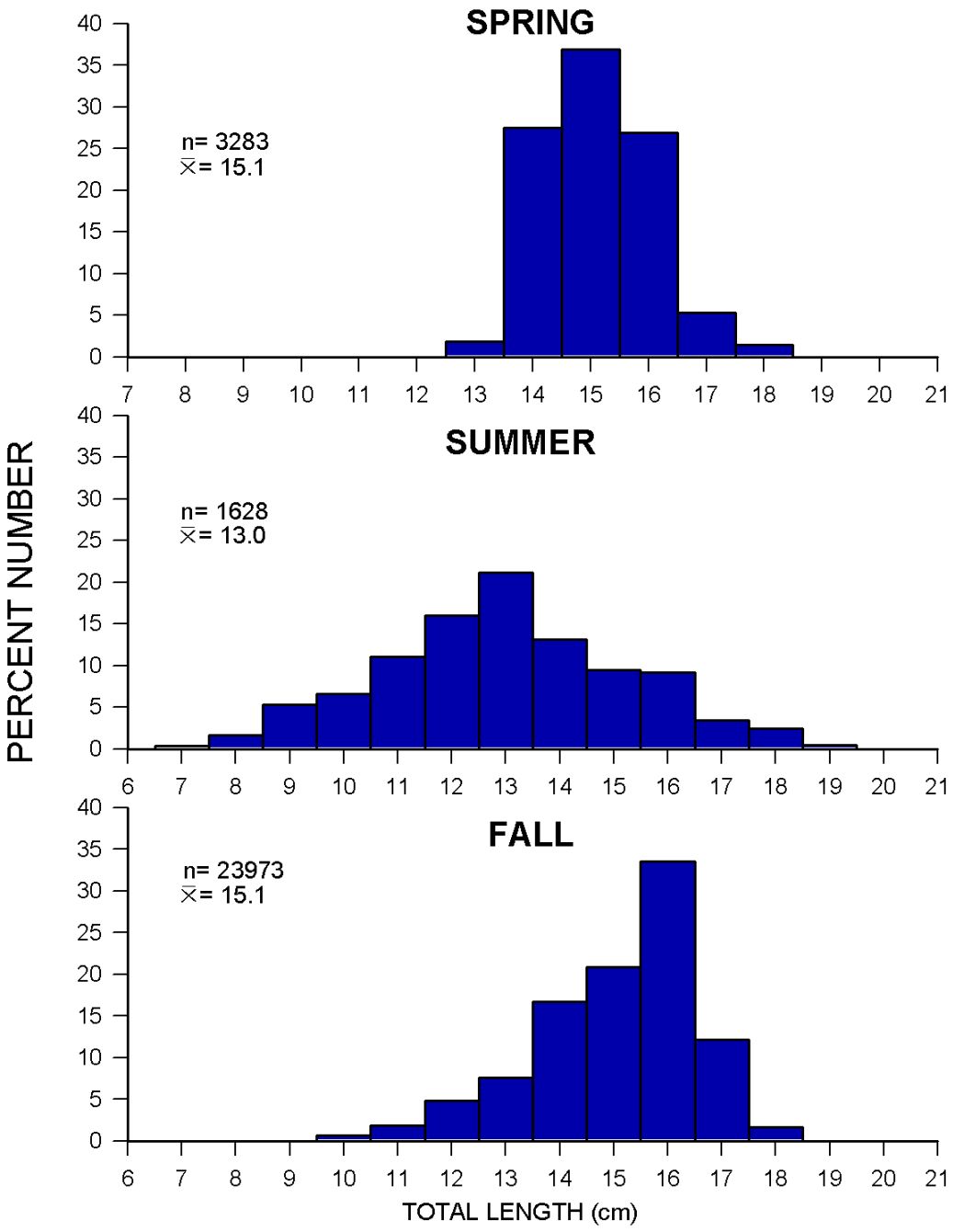

Figure 56. Seasonal length-frequencies of *Litopenaeus setiferus* in 2004

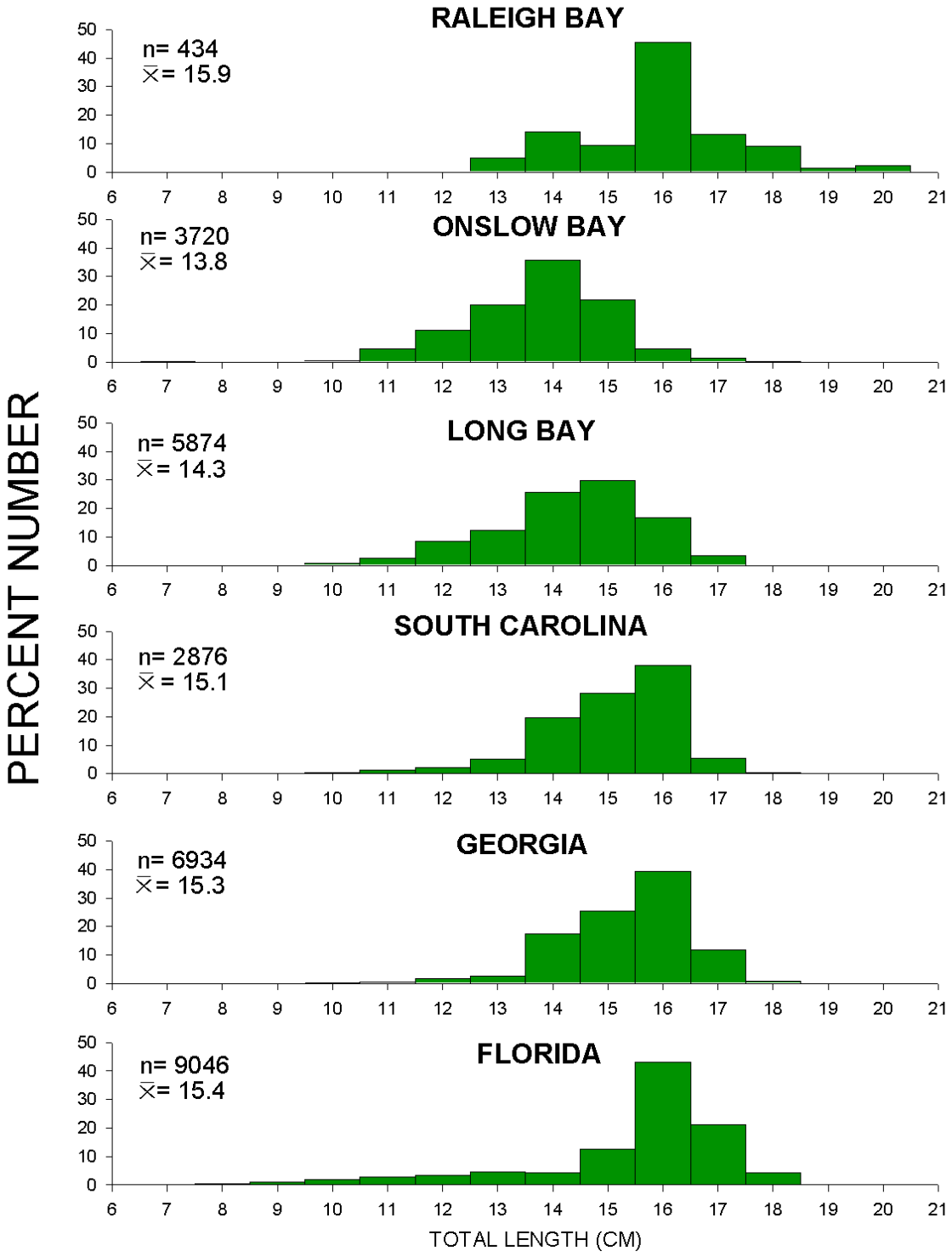

Figure 57. Regional length-frequencies of *Litopenaeus setiferus* in 2004

The majority of the white shrimp sampled (57%) were female. Less than 4% of females collected in SEAMAP-SA Shallow Water Trawl Survey strata had ripe ovaries, and none of the white shrimp females collected were ripe in fall, when 87% of the females were taken. The majority of ripe females were taken in spring (Figure 58). The ratio of ripe to nonripe females was not independent of season ($G = 2915$, $p < 0.0001$) or region ($G = 1152$, $p < 0.0001$). Less than 1% of the females taken in SEAMAP-SA trawls were mated. White shrimp are reported to spawn from May through September in the SAB (Lindner and Anderson, 1956; Williams, 1984). The majority of males with fully developed spermatophores were taken in spring. Very few males with fully developed spermatophores were taken in fall, when the majority (78%) of the males taken were collected. The ratio of males with fully developed spermatophores to those with spermatophores not yet fully developed was not independent of seasons ($G = 4635$, $p < 0.0001$) or regions ($G = 1067$, $p < 0.0001$).

Occurrence of black gill disease in commercially important penaeids was observed and recorded. White shrimp exhibited the greatest level of infestation, at 5.4%. All white shrimp with black gill disease were taken in fall trawls (9% of white shrimp taken in fall). Infestation of white shrimp occurred in all regions except Raleigh Bay. The majority of the records of black gill disease (58%) were in waters off Georgia.

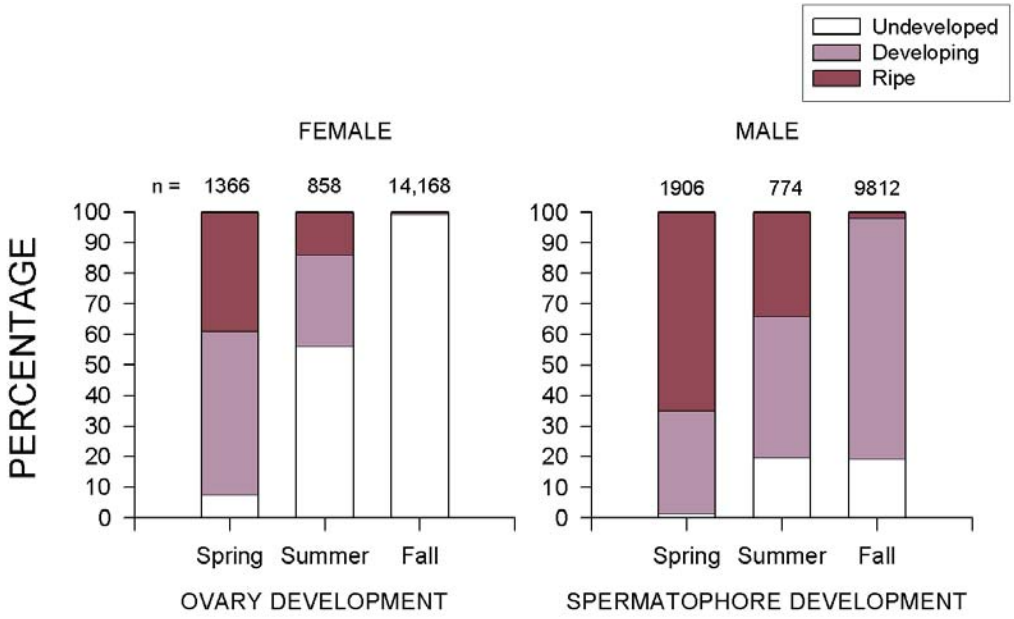

Figure 58. Gonadal development of *Litopenaeus setiferus* in 2004

Distribution and Abundance of Sharks

In 2004, the SEAMAP-SA Shallow Water Trawl Survey collected fourteen species of sharks (Table 27). The smooth dogfish, *Mustelus canis,* was the most abundant shark, making up approximately 46% of the shark specimens collected. The Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, ranked second in abundance (32%), followed by the bonnethead shark, *Sphyrna tiburo* (13%), and the spiny dogfish, *Squalus acanthias* (8%). The other nine species contributed less than 2% to the overall number of sharks collected.

Table 27. Sharks taken by the SEAMAP-SA Shallow Water Trawl Survey in 2004.

Rank	Common name	Species name	Number
1	Smooth dogfish	*Mustelus canis*	1444
2	Atlantic sharpnose	*Rhizoprionodon terraenovae*	1003
3	Bonnethead	*Sphyrna tiburo*	417
4	Spiny dogfish	*Squalus acanthias*	260
5	Scalloped hammerhead	*Sphyrna lewini*	10
6	Blacknose shark	*Carcharhinus acronotus*	8
7	Sandbar shark	*Carcharhinus plumbeus*	6
8	Sand tiger shark	*Odontaspis taurus*	4
9	Atlantic angel shark	*Squatina dumerili*	4
10	Spinner shark	*Carcharhinus brevipinna*	3
11	Blacktip shark	*Carcharhinus limbatus*	2
12	Thresher shark	*Alopias vulpinus*	2
13	Dusky shark	*Carcharhinus obscurus*	1

Mustelus canis

The smooth dogfish, *Mustelus canis,* was the most abundant shark species (n=1444; 1.3 individuals/ha; CV=7.1) collected during the 2004 SEAMAP-SA Shallow Water Trawl Survey. An increase in abundance has been noted over the past several years. The 2004 density of abundance was the highest since the peak observed in 1990 (Figure 59). Over 99% of the individuals were taken in spring. Smooth dogfish were taken primarily in the northern SAB, with abundance decreasing from Raleigh Bay southward (Table 28).

Male *M. canis* outnumbered females (1.5 : 1.0). Size differences between sexes were not found to be significant ($X^2 = 0.1$, $p > 0.05$). Total lengths of the smooth dogfish ranged from 48 to 116 cm for females ($\bar{x}$ = 67.7 cm, n = 569) and 22 to 104 cm for males ($\bar{x}$ = 68.1 cm, n = 875). Mean length was smallest in Raleigh Bay where abundance was greatest.

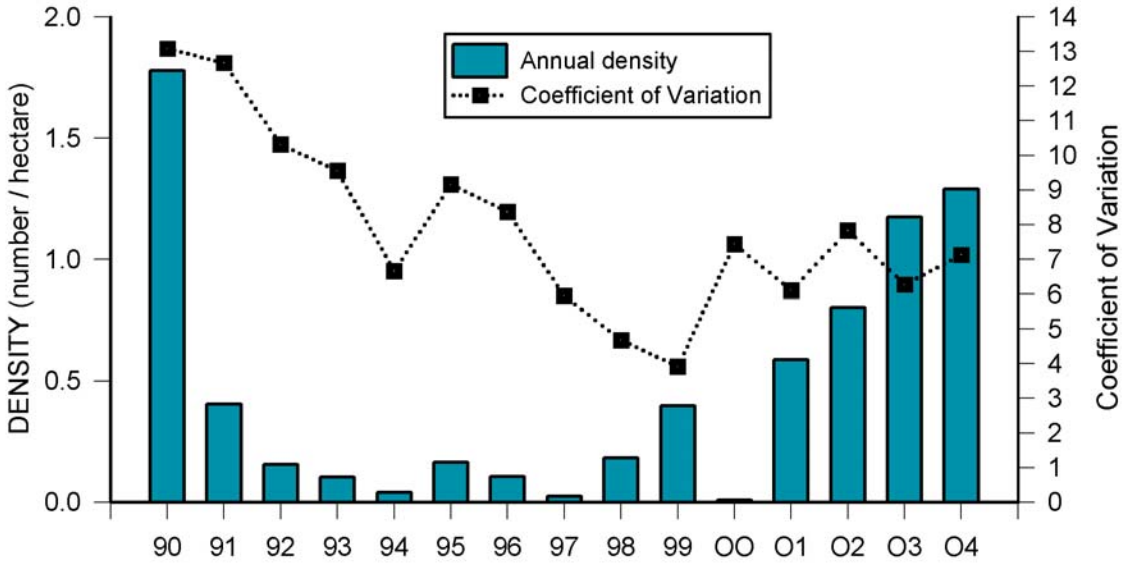

Figure 59. Annual densities of *Mustelus canis*

Table 28 . Estimates of density (number of individuals/hectare) in 2004.

Mustelus canis

	Spring	Summer	Fall	Region
Raleigh Bay	17.3	0.1	0	5.5
Onslow Bay	10.9	0.02	0	3.6
Long Bay	2.2	0	0	0.7
South Carolina	0.06	0	0	0.02
Georgia	0.02	0	0.01	0.01
Florida	0.01	0	0	0.005
Season	3.8	0.02	0.003	1.3

Rhizoprionodon terraenovae

The Atlantic sharpnose shark was the second most abundant shark species collected in 2004 (n=1003; 0.9 individuals/ha; CV=2.7). The density of abundance of *R. terraenovae* decreased in 2004 from the peak observed in 2003 (Figure 60). In 2004, Atlantic sharpnose were taken in all regions and all seasons. The highest densities of abundance were taken in summer (Table 29).

Although males outnumber females (1.1:1), size did not differ significantly among sexes (X^2 =0.1, p > 0.5). Females ranged in size from 27 to 109 cm total length ($\bar{x}$ = 43.1 cm, n =472), whereas males ranged from 26 to 99 cm ($\bar{x}$ = 50.4 cm, n = 531). Mean length was smallest in summer collections, when the greatest number of individuals were taken. Regional mean lengths were greatest off Georgia.

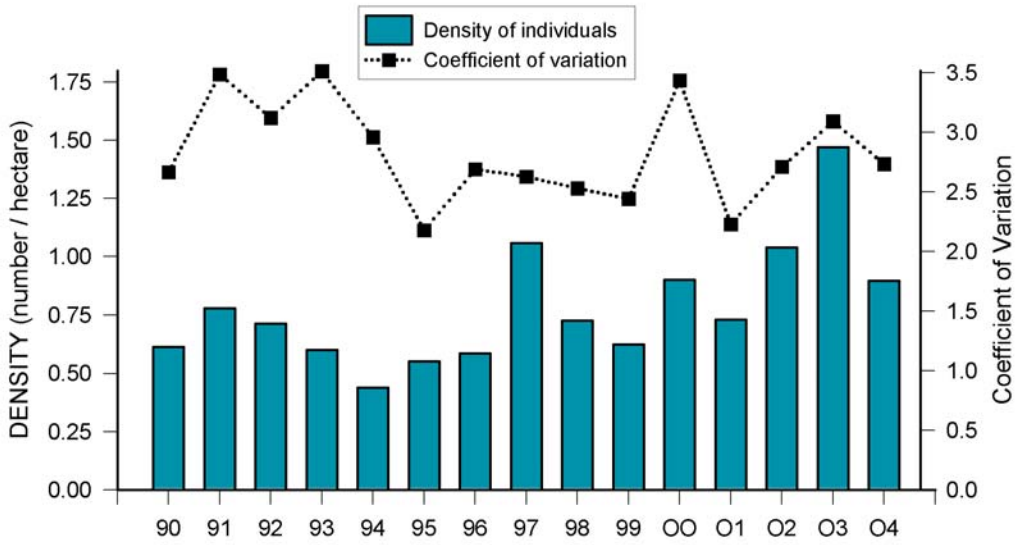

Figure 60. Annual densities of *Rhizoprionodon terraenovae*

Table 29 . Estimates of density (number of individuals/hectare) in 2004.

Rhizoprionodon terraenovae

	Spring	Summer	Fall	Region
Raleigh Bay	0	1.7	0.03	0.6
Onslow Bay	0.09	3.3	0.6	1.3
Long Bay	0.3	3.2	0.5	1.3
South Carolina	0.5	2.2	0.06	0.9
Georgia	0.4	1.6	0.2	0.7
Florida	0.3	0.5	1.1	0.6
Season	0.3	2.0	0.4	0.9

Sphyrna tiburo

The bonnethead shark, *Sphyrna tiburo,* ranked third in abundance (n=417; 0.4 individuals/ha; CV=6.3) among sharks in 2004. Although abundance decreased from the levels observed in 2002 and 2003, the 2004 estimate of density was the third highest abundance taken by the survey (Figure 61). Density was greatest in spring collections and in the southern SAB (Table 30). Waters off Florida yielded the highest regional density. No bonnethead sharks were taken in Raleigh Bay in any season.

Males outnumbered female bonnetheads (1.1:1), but were not significantly larger than females (X^2 = 0.8, p > 0.05). Total lengths of female *S. tiburo* ranged from 39 to 125 cm ($\bar{x}$ = 58.8 cm, n =196), whereas males ranged from 38 to 103 cm ($\bar{x}$ = 60.0 cm, n =221). Greatest mean lengths occurred in Onslow Bay and decreased southward for both sexes.

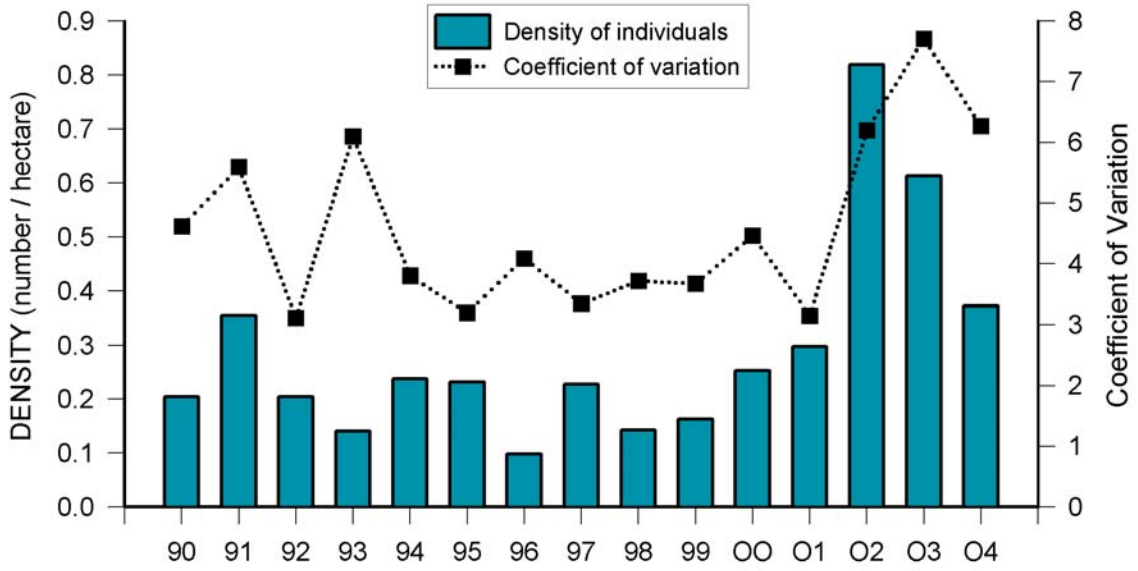

Figure 61. Annual densities of *Sphyrna tiburo*

Table 30 . Estimates of density (number of individuals/hectare) in 2004.

Sphyrna tiburo

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0	0.06	0	0.02
Long Bay	0.02	0.1	0.02	0.05
South Carolina	0.2	0.08	0.1	0.1
Georgia	0.1	0.2	0.05	0.1
Florida	5.0	0.06	0.03	1.8
Season	1.0	0.09	0.04	0.4

Squalus acanthias

The spiny dogfish, *Squalus acanthias,* was the fourth most abundant shark species (n=260; 0.2 individuals/ha; CV=9.8) collected during the 2004 SEAMAP-SA Shallow Water Trawl Survey. Densities of abundance were the highest observed in the history of the survey (Figure 62). Spiny dogfish were exclusive to Raleigh and Onslow Bays in spring (Table 31).

Females outnumbered male spiny dogfish (16:1) and were significantly larger than males ($X^2 = 28.9$, $p < 0.0001$). Total lengths of female *S. acanthias* ranged from 74 to 99 cm ($\bar{x}$ = 82.1 cm, n =245), whereas males ranged from 72 to 83 cm ($\bar{x}$ = 74.1 cm, n =15).

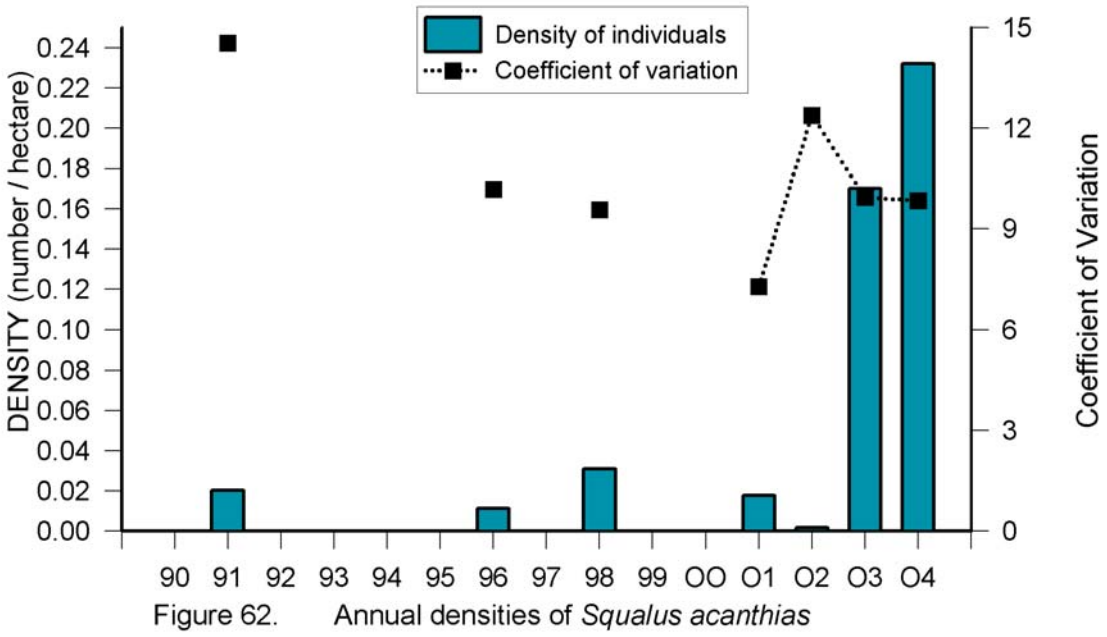

Figure 62. Annual densities of *Squalus acanthias*

Table 31. Estimates of density (number of individuals/hectare) in 2004.

Squalus acanthias

	Spring	Summer	Fall	Region
Raleigh Bay	7.1	0	0	2.2
Onslow Bay	0.2	0	0	0.05
Long Bay	0	0	0	0
South Carolina	0	0	0	0
Georgia	0	0	0	0
Florida	0	0	0	0
Season	0.7	0	0	0.2

Distribution and Abundance of Sea Turtles

Caretta caretta

The loggerhead turtle, *Caretta caretta*, was the most abundant sea turtle caught in SEAMAP trawls. Twenty-six loggerhead turtles (CV=4.8; 0.02 individuals/ha), weighing 1463 kg (1.5 kg/ha), were taken in 2004. The 2004 estimate of density represents a decrease in abundance from the highest recorded in 2003 (Figure 63). In 2004, the overall seasonal densities did not vary a great deal, although abundance was slightly higher in summer (Table 32). Regionally, density was greatest in waters off Florida. The majority of the loggerhead sea turtles taken in SEAMAP collections are considered to be sub-adults, based on size (Dodd, 1988).

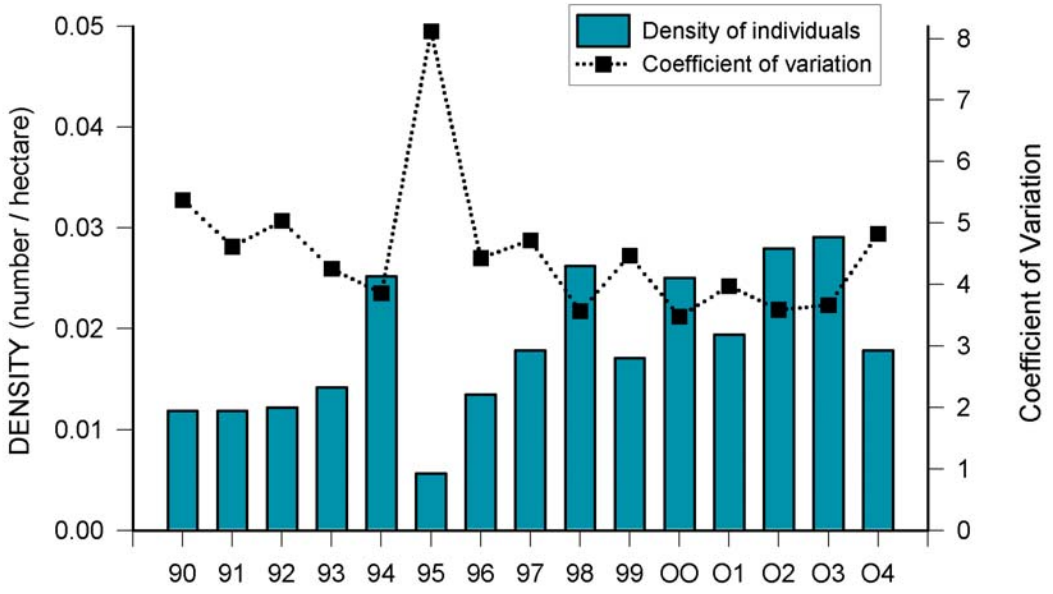

Figure 63. Annual densities of *Caretta caretta*

Table 32. Estimates of density (number of individuals/hectare) in 2004.

Caretta caretta

	Spring	Summer	Fall	Region
Raleigh Bay	0.03	0	0	0.009
Onslow Bay	0.03	0.02	0	0.02
Long Bay	0	0	0.02	0.007
South Carolina	0	0.05	0.02	0.02
Georgia	0.01	0.03	0.03	0.02
Florida	0.06	0.08	0.02	0.05
Season	0.02	0.03	0.02	0.02

Dermochelys coriacea

The leatherback turtle has been a very rare species in SEAMAP-SA trawls. In 2004, one leatherback turtle was taken in SEAMAP collections (in South Carolina waters during the spring cruise). Only three leatherback turtles have been taken previously.

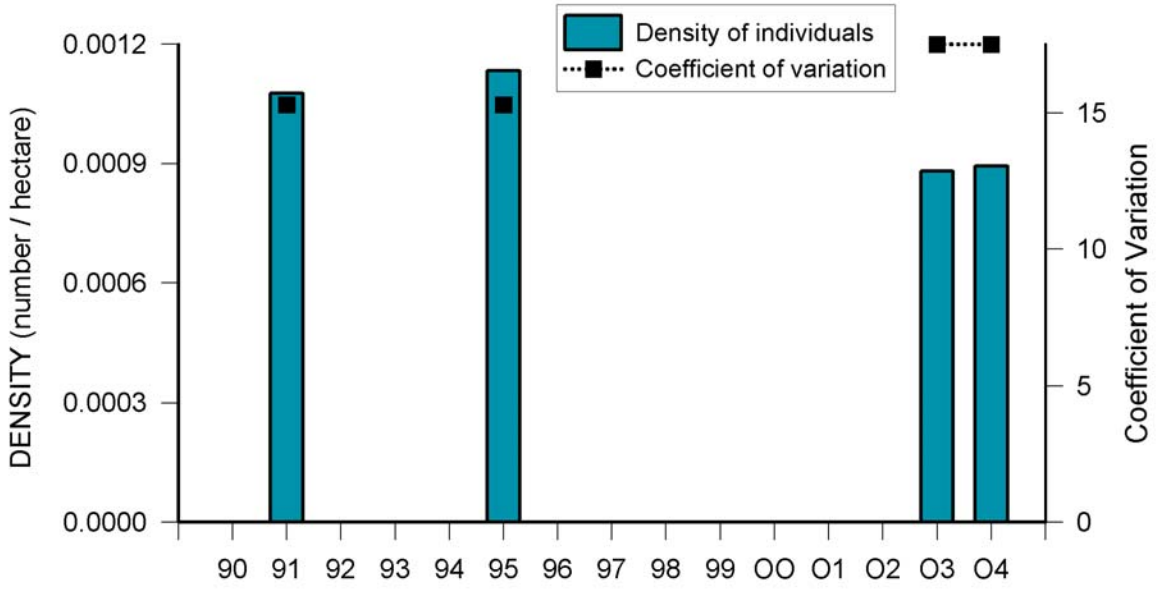

Figure 64. Annual densities of *Dermochelys coriacea*

Lepidochelys kempi

In 2004, five Kemp's ridley turtles were taken in SEAMAP trawls (CV=12.3; 0.004 individuals/ha). The estimate of density of *L. kempi* was far below the record level observed in 2003 (Figure 64). No Kemp's ridley turtles were taken in Raleigh Bay or Florida (Table 33).

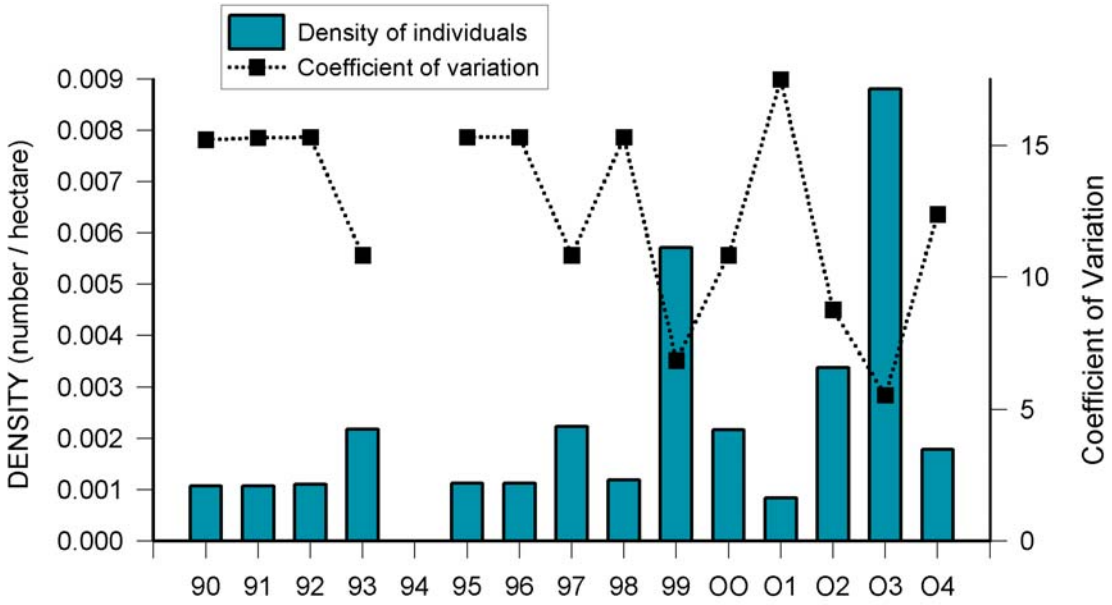

Figure 65. Annual densities of *Lepidochelys kempi*

Table 33. Estimates of density (number of individuals/hectare) in 2004.

Lepidochelys kempi

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0	0	0.02	0.005
Long Bay	0	0	0.02	0.007
South Carolina	0	0	0.02	0.005
Georgia	0.01	0.01	0	0.007
Florida	0	0	0	0
Season	0.003	0.003	0.008	0.004

Distribution and Abundance of Horseshoe Crabs

Limulus polyphemus

A total of 171 horseshoe crabs (CV=6.5; 0.2 individuals/ha) were collected by the SEAMAP-SA Shallow Water Trawl Survey in 2004. Density of individuals in 2004 was the greatest estimate recorded by the survey (Figure 65). In 2004, horseshoe crabs were taken in all regions and seasons (Table 34). Abundance was greatest in spring trawls made in Raleigh Bay.

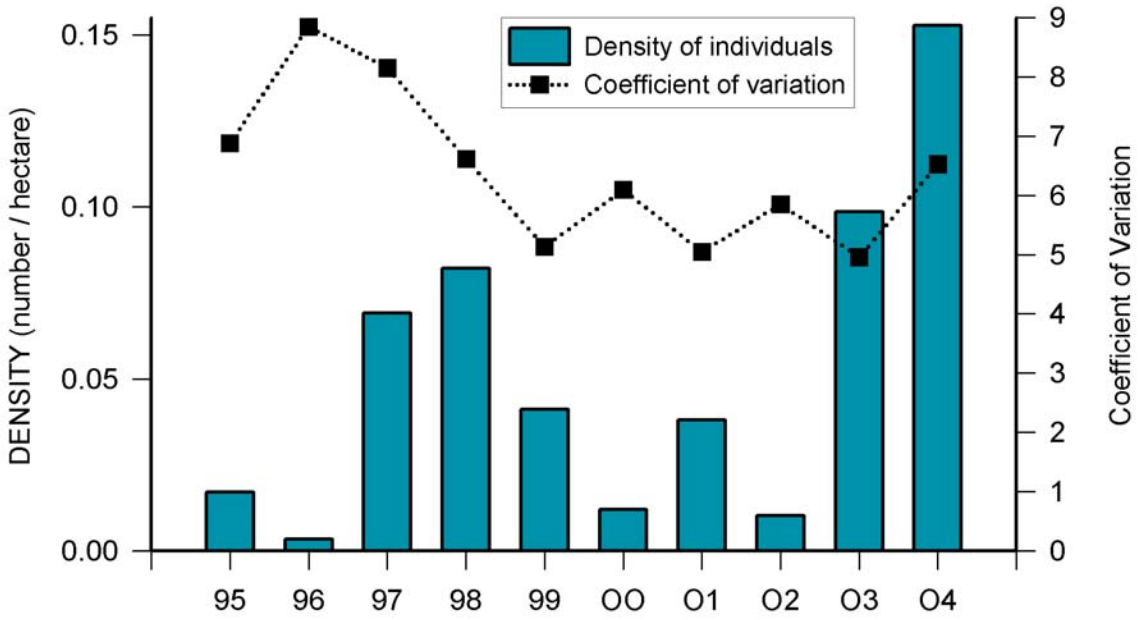

Figure 66. Annual densities of *Limulus polyphemus*

Table 34. Estimates of density (number of individuals/hectare) in 2004.

Limulus polyphemus

	Spring	Summer	Fall	Region
Raleigh Bay	3.2	0.2	0.1	1.1
Onslow Bay	0.02	0	0	0.005
Long Bay	0.2	0	0	0.06
South Carolina	0.1	0.05	0	0.05
Georgia	0.04	0.01	0.02	0.02
Florida	0.3	0.03	0.02	0.1
Season	0.4	0.4	0.02	0.2

Distribution and Abundance of Cannonball Jellies

In 2001, the cannonball jelly, having been identified as a major component of overall biomass and a species of increasing commercial importance, was separated from other miscellaneous invertebrates and the abundance and biomass of *Stomolophus meleagris* was recorded for the first time by the SEAMAP - South Atlantic Shallow Water Trawl Survey.

The 694 individuals (0.6 individuals/ha; CV=4.3, weighing 182 kg (0.28.6 kg/ha), made up less than 1% of the total number and total biomass of specimens taken in SEAMAP-SA Shallow Water Trawl Survey strata in 2004. Cannonball jelly abundance has declined since 2001 (Figure 67). Seasonal density was greatest in fall (Table 35). *Stomolophus meleagris* was taken in all regions, with highest regional densities off South Carolina and Georgia.

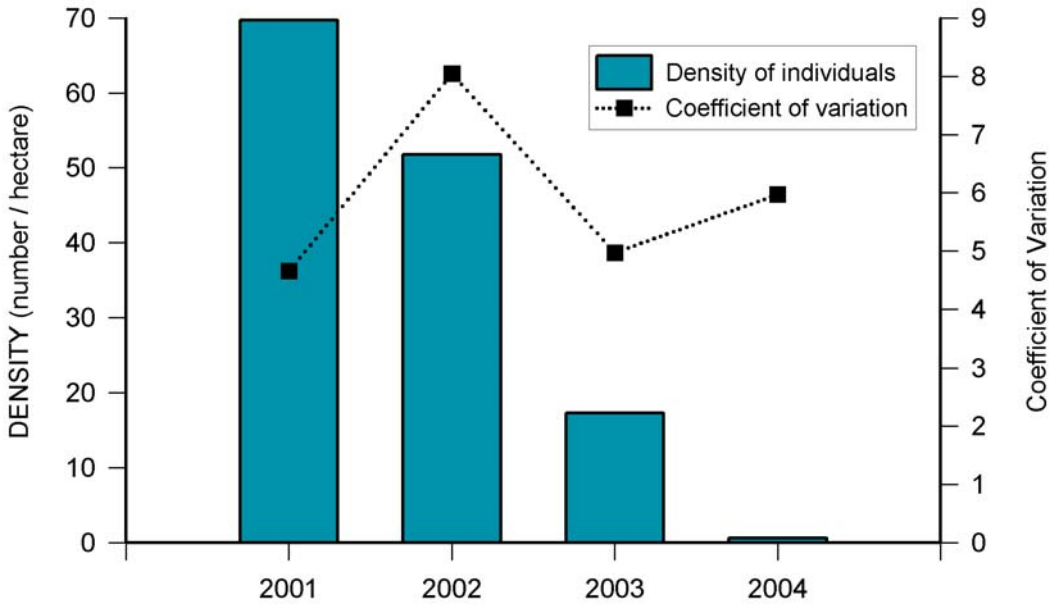

Figure 67. Annual densities of *Stomolophus meleagris*

Table 35. Estimates of density (number of individuals/hectare) in 2004.

Stomolophus meleagris

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0	0	0.03	0.01
Long Bay	0.02	0	0.3	0.1
South Carolina	0.3	0.3	5.9	2.2
Georgia	0.01	0.8	1.8	0.9
Florida	0	0	0.4	0.1
Season	0.06	0.2	1.6	0.6

ACKNOWLEDGMENTS

We appreciate the administrative assistance of Dale Theiling, David Cupka, Wayne Waltz, and David Whitaker and the recommendations of the SEAMAP-SA Committee and the Shallow Water Trawl Workgroup. Jeff Jacobs, Rob Dunlap, and Paul Tucker were instrumental in the successful completion of SEAMAP-SA Shallow Water Trawl Survey cruises through their able operation of the R/V *Lady Lisa*. Justin Frichtel and Lee Weller assisted with field efforts.

APPLICATIONS OF DATA AND SPECIMENS FROM THE SEAMAP-SOUTH ATLANTIC SHALLOW WATER TRAWL SURVEY IN 2004

Stock Assessment/VPA:

Brevoortia tyrannus
Centropristis striata
Cynoscion regalis
Limulus polyphemus
Micropogonias undulatus
Pomatomus saltatrix
Scomberomorus cavalla
Scomberomorus maculatus

Life History (Age/Growth, Reproduction):

Cynoscion regalis
Diplectrum formosum
Haemulon aurolineatum
Menticirrhus americanus
Menticirrhus littoralis
Menticirrhus saxatilis
Micropogonias undulatus
Pomatomus saltatrix
Seriola dumeril

Genetics / Stock Identification Studies:

Menticirrhus americanus
Menticirrhus littoralis
Menticirrhus saxatilis
Micropogonias undulatus

Educational Research:

Fistularia and *Ogcocephalus* data for publication on regional abundance

Data requested by state agencies:

Specimens of invertebrate species for catalogue of voucher specimens -SCDNR/MRRI -SERTC
Specimens of fish species for catalogue of voucher specimens -College of Charleston -SERTC
Blue crab sponge crab abundance - SCDNR-Crustacean Management Section
Shrimp abundance summary - SCDNR-Crustacean Management Section
Incidence of black gill disease in commercial penaeid shrimp - SCDNR - Crustacean Management Section

Water temperature data (Summer 2004) - SCDNR/MRRI
Sea turtle data (2004) - SCDNR / Office of Fisheries Management
2004 SEAMAP-SA data collected in North Carolina waters - NC Division of Marine Fisheries
2000-2002 SEAMAP-SA data collected in North Carolina waters - NC Division of Marine Fisheries
2004 SEAMAP-SA data collected in Georgia waters - GADNR
Sea turtle data collected in Georgia waters(2004) - GADNR
2004 SEAMAP-SA data collected in Florida waters - Florida Fish and Wildlife Conservation Commission
Sea turtle data collected in Florida waters(2004) - FFWCC - Endangered Species Division
Cannonball jelly abundance data (1994-2004) for correlation with Leatherback sea turtle sightings-/SCDNR-Endangered Species Office

Data requested by federal agencies:

Sea turtle data (2004) - NOAA SEFSC
Sea turtle data (2004) - Cooperative Marine Turtle Tagging Program
Shark data (2004) - NMFS, Narrangansett Lab
Shark data (2004) - NMFS, Highly Migratory Species, Silver Spring, MD
Data collected off Canaveral National Seashore (2004) - National Park Service

SEAMAP-SA SHALLOW WATER TRAWL SURVEY PERMITS

The SEAMAP - South Atlantic Shallow Water Trawl Survey applies for required permits each year. In 2004, the survey operated in compliance with the following:

Federal Permits

Letter of Acknowledgement from USDOC/NOAA/NMFS Southeast Regional Office (variance from size, bag, and seasonal limits for monitored stocks).

Letter of Authorization from USDOC/NOAA/NMFS Southeast Regional Office (exemption from federal TED requirements as long as limited tow times are maintained).

Letter of Acknowledgement (LOA-SHK-03-01) from USDOC/NOAA/NMFS Office of Sustainable Fisheries (allows research trawling activity that includes take of shark species).

Permit #1405 from USDOC/NOAA/NMFS Office of Protected Resources (authorizes specified research on marine turtle species collected as a result of otherwise permitted trawling activities).

USDOC/NOAA/NMFS Section 6 Cooperative Agreement (recognizes South Carolina Department of Natural Resources' actions under section 6(c) of the Endangered Species Act).

CANA-2004-SCI-0007 issued by USDOI/NPS Canaveral National Seashore (authorizes trawling activities in the coastal waters adjacent to the park).

STATE PERMITS

North Carolina Division of Marine Fisheries Scientific/Educational Permit (Permit Number 706572).

South Carolina Department of Natural Resources Scientific Collection Permit.

State of Georgia Department of Natural Resources Scientific Collecting Permit (29-WMB-03-190).

Florida Fish and Wildlife Conservation Commission Special Activities License (SAL 03SR-051).

Florida Fish and Wildlife Conservation Commission / Bureau of Protected Species Management Marine Turtle Permit (TP# 064).

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Appendix 1. Size statistics of priority finfish and decapod species from all SEAMAP-SA collections in 2004.

FINFISH	MEAN LENGTH/WIDTH (CM)	SIZE EXTREMES (CM)
Archosargus probatocephalus	48.1	42 - 54
Brevoortia smithi	27.0	24 - 29
Brevoortia tyrannus	13.4	8 - 22
Centropristis striata	14.1	7 - 25
Chaetodipterus faber	9.2	4 - 17
Cynoscion nebulosus	**	
Cynoscion regalis	18.2	5 - 36
Leiostomus xanthurus	14.6	7 - 27
Menticirrhus americanus	19.7	6 - 37
Menticirrhus littoralis	22.6	12 - 38
Menticirrhus saxatilis	24.2	14 - 34
Micropogonias undulatus	17.6	9 - 28
Mycteroperca microlepis	**	
Paralichthys albigutta	29.8	18 - 43
Paralichthys dentatus	23.9	11 - 43
Paralichthys lethostigma	31.4	16 - 46
Peprilus paru	11.5	3 - 20
Peprilus triacanthus	12.2	4 - 18
Pogonias cromis	*	
Pomatomus saltatrix	17.3	10 - 33
Sciaenops ocellatus	**	
Scomberomorus cavalla	15.5	5 - 36
Scomberomorus maculatus	22.5	10 - 54
DECAPOD CRUSTACEANS		
Callinectes sapidus	13.3	5 - 20
Farfantepenaeus aztecus	12.1	8 - 18
Farfantepenaeus duorarum	12.3	8 - 18
Litopenaeus setiferus	14.9	7 - 20

* A single specimen of *Pogonias cromis* was collected.

** No specimens of *Cynoscion nebulosus, Mycteroperca microlepis,* or *Sciaenops ocellatus* were collected.

Appendix 2. Seasonal age-length keys for weakfish, southern kingfish, and Atlantic croaker taken in SEAMAP-SA trawls in 2004.

Cynoscion regalis

SPRING 2004						
TL	N	Age 0	Age 1	Age 2	Age 3	Age 4
10	2		100			
11	1		100			
12	4		100			
13	7		100			
14	3		100			
15	7		100			
16	8		100			
17	12		100			
18	20		100			
19	28		100			
20	30		100			
21	31		100			
22	21		95	5		
23	23		78	22		
24	18		89	11		
25	10		70	30		
26	10		60	40		
27	5		20	60	20	
28	1			100		
30	3			100		
31	1			100		
33	1			100		

SUMMER 2004						
TL	N	Age 0	Age 1	Age 2	Age 3	Age 4
10	3	100				
11	5	100				
12	5	100				
13	11	100				
14	9	78	22			
15	13	85	15			
16	13	85	15			
17	10	80	20			
18	7	57	43			
19	4	25	75			
20	4		100			
21	6		100			
22	6		100			
23	12		100			
24	10		80	20		
25	14		86	14		
26	6		83	17		
27	5		40	06		
28	4		75	02		
29	1			100		
30	3		33	67		
32	1			100		
36	1			100		

FALL 2004						
TL	N	Age 0	Age 1	Age 2	Age 3	Age 4
6	1	100				
9	2	100				
10	1	100				
11	5	100				
12	8	100				
13	11	100				
14	16	100				
11	12	91	9			
16	7	100				
17	8	100				
18	10	100				
19	12	100				
20	12	83	17			
21	11	73	27			
22	9	56	44			
23	10	70	30			
24	8	38	63			
25	5	20	60	20		
26	10		60	40		
27	8		88	13		
28	6		83	17		
29	1			100		
30	3		67	33		
31	3		100			
33	1		100			
37	1				100	

Appendix 2. continued

Menticirrhus americanus

Seasonal age-length keys

SPRING 2004								
TL	N	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
9	1		100					
11	11		100					
12	19		100					
13	19		100					
14	19		100					
15	22		100					
16	24		100					
17	26		100					
18	37		100					
19	34		97	3				
20	34		94	6				
21	40		93	8				
22	38		61	39				
23	36		31	69				
24	39		16	79	3			2
25	38		5	84	8	3		
26	36		6	75	19			
27	36		3	75	17	5		
28	32		6	50	35	6	3	
29	20			45	40	10	5	
30	21			14	76	10		
31	15			27	67	7		
32	11			9	82	9		
33	1				100			
34	4					50	50	
35	1					100		
36	1				100			
37	2				50	50		

SUMMER 2004								
TL	N	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
7	1	100						
10	4	100						
11	13	100						
12	14	100						
13	21	100						
14	12	100						
15	18	78	22					
16	17	53	47					
17	14	36	64					
18	26	23	77					
19	27	27	73					
20	38	11	89					
21	33	18	82					
22	32		81	19				
23	30	3	80	17				
24	36		53	44	3			
25	24		33	50	17			
26	21		10	62	29			
27	12			42	50		8	
28	11			64	36			
29	5		20	20	60			
30	10			75		25		
31	3			33	67			
32	1							
33	1				100			
34	1					100		

FALL 2004								
TL	N	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
8	2	100						
9	4	100						
10	7	100						
11	8	100						
12	16	100						
13	22	100						
14	15	100						
15	30	100						
16	24	100						
17	33	100						
18	29	100						
19	32	97	3					
20	29	90	7	3				
21	33	73	27					
22	30	60	33	7				
23	36	39	56	6				
24	33	15	73	12				
25	25		80	20				
26	28		57	43				
27	23	4	52	39	4			
28	22		36	41	23			
29	18		6	78	11		6	
30	11			82	18			
31	10			70	20	10		
32	6			83	17			
33	3			33	33	33		
34	8			13	88			
35	2			50		50		
37	1					100		
38	1					100		

Appendix 2. continued

Micropogonias undulatus

Seasonal age-length keys

SPRING 2004							
TL	N	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5
10	1	100					
11	6	100					
12	7	100					
13	7	71	29				
14	7	57	43				
15	8	12	88				
16	14	7	93				
17	21		100				
18	18		100				
19	11		91	9			
20	13		92	8			
21	7		43	57			
22	10		40	40	20		
23	2			50	50		
24	4			50	50		
25	1				100		
26	2			50	50		

SUMMER 2004							
TL	N	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5
11	5	80	20				
12	8	100					
13	16	94	6				
14	27	85	15				
15	26	92	8				
16	28	61	39				
17	30	43	57				
18	29	24	69	7			
19	30	27	73				
20	22	5	76	19			
21	14		43	50	7		
22	16		33	40	20	7	
23	4		25	50		25	
24	2			50	50		
25	1				100		

FALL 2004							
TL	N	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5
13	3	100					
14	4	100					
15	16	100					
16	24	100					
17	32	97	3				
18	28	96	4				
19	25	72	28				
20	29	59	41				
21	23	22	78				
22	20	10	65	25			
23	12	17	42	33			8
24	4		25	25	25	25	
28	1			100			

Appendix 3. Number of individuals and biomass (kg) for all species collected in 2004.

Rank	Species Name	Total Number	Total Weight
1	*Micropogonias undulatus*	108181	7464.465
2	*Anchoa hepsetus*	81670	697.404
3	*Leiostomus xanthurus*	69223	3666.936
4	*Peprilus triacanthus*	38900	1652.672
5	*Stenotomus sp.*	29589	1046.045
6	*Litopenaeus setiferus*	28884	859.773
7	*Lagodon rhomboides*	27314	1176.212
8	*Larimus fasciatus*	21501	907.849
9	*Menticirrhus americanus*	20394	1828.472
10	*Cynoscion regalis*	18818	1152.346
11	*Cynoscion nothus*	16628	400.832
12	*Lolliguncula brevis*	13713	147.601
13	*Prionotus carolinus*	11352	200.608
14	*Chloroscombrus chrysurus*	11083	406.637
15	*Stellifer lanceolatus*	10561	197.906
16	*Farfantepenaeus aztecus*	9828	169.742
17	*Synodus foetens*	8932	555.328
18	*Portunus gibbesii*	7506	24.616
19	*Opisthonema oglinum*	7186	157.968
20	*Orthopristis chrysoptera*	6966	478.773
21	*Anchoa mitchilli*	6574	14.500
22	*Selene setapinnis*	5848	126.736
23	*Ovalipes stephensoni*	5836	50.953
24	*Trichiurus lepturus*	5642	203.006
25	*Pomatomus saltatrix*	5463	381.771
26	*Bairdiella chrysoura*	4465	134.051

Rank	Species Name	Total Number	Total Weight
27	*Callinectes similis*	3669	54.995
28	*Peprilus paru*	3319	245.688
29	*Urophycis regius*	3008	70.305
30	*Loligo sp.*	2506	32.498
31	*Prionotus scitulus*	2335	45.688
32	*Anchoa lyolepis*	1786	3.150
33	*Ovalipes ocellatus*	1638	24.448
34	*Scomberomorus cavalla*	1623	73.803
35	*Scophthalmus aquosus*	1574	35.355
36	*Mustelus canis*	1444	1655.963
37	*Prionotus evolans*	1417	45.151
38	*Etropus crossotus*	1346	25.503
39	*Trinectes maculatus*	1313	35.204
40	*Scomberomorus maculatus*	1100	133.678
41	*Citharichthys macrops*	1073	19.677
42	*Arenaeus cribrarius*	1062	23.945
43	*Rhizoprionodon terraenovae*	1003	619.866
44	*Callinectes sapidus*	995	125.886
45	*Brevoortia tyrannus*	945	43.874
46	*Gymnura micrura*	944	836.438
47	*Ancylopsetta quadrocellata*	904	48.453
48	*Raja eglanteria*	867	1058.381
49	*Squilla neglecta*	814	12.518
50	*Eucinostomus sp.*	780	11.051
51	*Symphurus plagiusa*	764	22.768
52	*Decapterus punctatus*	756	54.387
53	*Menticirrhus littoralis*	719	94.094

Rank	Species Name	Total Number	
54	*Squilla empusa*	701	9.553
55	*Dasyatis sayi*	656	922.540
56	*Portunus spinimanus*	601	14.944
57	*Selene vomer*	591	12.633
58	*Callinectes ornatus*	587	7.826
59	*Paralichthys dentatus*	538	85.168
60	*Chilomycterus schoepfi*	487	123.841
61	*Sphoeroides maculatus*	475	41.950
62	*Chaetodipterus faber*	466	20.017
63	*Farfantepenaeus duorarum*	429	8.353
64	*Sphyrna tiburo*	417	465.988
65	*Sphyraena guachancho*	409	60.783
66	*Pagurus pollicaris*	385	9.021
67	*Harengula jaguana*	324	5.168
68	*Prionotus salmonicolor*	316	5.975
69	*Etropus cyclosquamus*	286	3.261
70	*Hepatus epheliticus*	281	7.993
71	*Libinia dubia*	261	2.998
72	*Squalus acanthias*	260	602.996
73	*Rhinoptera bonasus*	239	1352.876
74	*Myliobatis freminvillei*	229	896.962
75	*Libinia emarginata*	228	7.141
76	*Caranx hippos*	204	12.467
77	*Persephona mediterranea*	189	2.319
78	*Haemulon aurolineatum*	181	4.939
79	*Caranx crysos*	180	17.376
80	*Limulus polyphemus*	171	238.223
81	*Centropristis striata*	162	7.828

Rank	Species Name	Total Number	
82	*Trachinotus carolinus*	155	26.300
83	*Dasyatis sabina*	150	35.613
84	*Menticirrhus saxatilis*	149	21.741
85	*Sardinella aurita*	141	1.094
86	*Paralichthys lethostigma*	126	48.444
87	*Centropristis philadelphica*	103	3.118
88	*Prionotus tribulus*	82	3.428
89	*Pareques umbrosus*	80	0.164
90	*Dasyatis americana*	77	248.371
91	*Syacium papillosum*	69	5.037
92	*Alosa aestivalis*	66	1.187
93	*Diplectrum formosum*	61	3.126
94	*Citharichthys spilopterus*	59	1.008
95	*Stephanolepis hispidus*	56	0.576
96	*Urophycis earlli*	52	3.021
97	*Calappa flammea*	48	9.712
98	*Urophycis floridanus*	40	1.917
99	*Echeneis naucrates*	40	7.224
100	*Cancer irroratus*	36	0.184
101	*Gymnura altavela*	35	874.237
102	*Mobula hypostoma*	34	747.830
103	*Narcine brasiliensis*	33	13.026
104	*Paralichthys albigutta*	31	10.599
105	*Caretta caretta*	26	1462.670
106	*Menippe mercenaria*	26	3.460
107	*Ogcocephalus vespertilio*	25	0.179
108	*Xiphopenaeus kroyeri*	23	0.232
109	*Dasyatis centroura*	20	492.120

Rank	Species Name	Total Number	
110	*Hippocampus erectus*	18	0.158
111	*Upeneus parvus*	18	0.465
112	*Archosargus probatocephalus*	16	44.750
113	*Paralichthys squamilentus*	16	0.856
114	*Neopanope sayi*	16	0.018
115	*Rimapenaeus constrictus*	15	0.049
116	*Ogcocephalus rostellum*	13	0.093
117	*Hypleurochilus geminatus*	12	0.030
118	*Aetobatus narinari*	11	260.230
119	*Hypoconcha arcuata*	11	0.157
120	*Sphyrna lewini*	10	26.575
121	*Syngnathus louisianae*	9	0.086
122	*Trachurus lathami*	9	0.081
123	*Carcharhinus acronotus*	8	72.690
124	*Rachycentron canadum*	8	10.973
125	*Etropus microstomus*	8	0.101
126	*Oligoplites saurus*	7	0.711
127	*Octopus vulgaris*	7	0.937
128	*Carcharhinus plumbeus*	6	15.070
129	*Rhinobatos lentiginosus*	6	3.409
130	*Elops saurus*	6	0.357
131	*Bagre marinus*	6	1.037
132	*Aluterus schoepfi*	6	1.074
133	*Lepidochelys kempi*	5	104.610
134	*Lophius americanus*	5	29.570
135	*Strongylura marina*	5	0.435
136	*Acanthostracion quadricornis*	5	2.128
137	*Pilumnus sayi*	5	0.025

Rank	Species Name	Total Number	
138	*Lysiosquilla scabricauda*	5	0.149
139	*Odontaspis taurus*	4	334.620
140	*Squatina dumeril*	4	47.700
141	*Porichthys plectrodon*	4	0.105
142	*Alectis ciliarius*	4	0.144
143	*Acipenser oxyrhynchus*	3	64.540
144	*Brevoortia smithi*	3	1.029
145	*Hypsoblennius hentzi*	3	0.032
146	*Carcharhinus brevipinna*	3	60.560
147	*Sicyonia brevirostris*	3	0.037
148	*Polyonyx gibbesi*	3	0.006
149	*Albunea paretii*	3	0.014
150	*Carcharhinus limbatus*	2	11.590
151	*Arius felis*	2	0.668
152	*Ogcocephalus parvus*	2	0.318
153	*Echeneis neucratoides*	2	0.495
154	*Lutjanus campechanus*	2	0.008
155	*Gobiosoma bosci*	2	0.002
156	*Lagocephalus laevigatus*	2	0.018
157	*Bothus robinsi*	2	0.039
158	*Alopias vulpinus*	2	23.700
159	*Lutjanus synagris*	2	0.011
160	*Pagurus longicarpus*	2	0.009
161	*Eurypanopeus depressus*	2	0.003
162	*Carcharhinus obscurus*	1	6.440
163	*Ophichthus gomesi*	1	0.040
164	*Histrio histrio*	1	0.010
165	*Fistularia tabacaria*	1	0.010

Rank	Species Name	Total Number	
166	*Syngnathus fuscus*	1	0.011
167	*Serranus subligarius*	1	0.001
168	*Caranx bartholomaei*	1	0.005
169	*Pogonias cromis*	1	0.222
170	*Astroscopus guttatus*	1	0.015
171	*Astroscopus y-graecum*	1	0.030
172	*Scorpaena brasiliensis*	1	0.016
173	*Prionotus ophryas*	1	0.019
174	*Gymnachirus melas*	1	0.034
175	*Torpedo nobiliana*	1	5.650
176	*Hyporhampus meeki*	1	0.013
177	*Dermochelys coriacea*	1	200.000
178	*Lysmata wurdemanni*	1	0.001
179	*Petrochirus diogenes*	1	0.215
180	*Pagurus impressus*	1	0.083
181	*Charybdis hellerii*	1	0.024
182	*Dromidia antillensis*	1	0.018
183	*Hexapanopeus angustifrons*	1	0.001
184	*Euryplax nitida*	1	0.002
185	*Pinnixa lunzi*	1	0.002